

General Disclaimer

One or more of the Following Statements may affect this Document

- This document has been reproduced from the best copy furnished by the organizational source. It is being released in the interest of making available as much information as possible.
- This document may contain data, which exceeds the sheet parameters. It was furnished in this condition by the organizational source and is the best copy available.
- This document may contain tone-on-tone or color graphs, charts and/or pictures, which have been reproduced in black and white.
- This document is paginated as submitted by the original source.
- Portions of this document are not fully legible due to the historical nature of some of the material. However, it is the best reproduction available from the original submission.

DID NO. _____
CDRL NO. _____
P.O. NO. _____
CONTRACT NO. NAS8-31973

DATA MGR. FILE NO. QTR 4918-245
DEPT FILE NO. _____
ISSUE DATE 7 August 1978
REVISION Original
SUPERSEDING _____
DATE _____

QUALIFICATION TEST
AND
FINAL PROGRAM REPORT

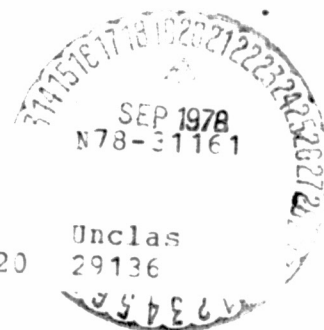
Volume 2

FOR
SAFETY AND ARMING DEVICE
MSFC PN 10A00465
TMC/S PN 816780

FOR
SPACE SHUTTLE SOLID ROCKET BOOSTER

PROGRAM PERFORMED BY
TELEDYNE MCCORMICK SELPH
HOLLISTER, CALIFORNIA
(NASA-CR-150793) QUALIFICATION TEST FOR
SAFETY AND ARMING DEVICE MSFC PN 10A00465
TMC/S PN 816780 FOR SPACE SHUTTLE SOLID
ROCKET BOOSTER, VOLUME 2
(Teledyne/McCormick Selph, Hollister,
TEST AUTHORIZED BY

GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, ALABAMA



Teledyne McCormick Selph

3601 UNION ROAD, HOLLISTER, CALIFORNIA 95023



This document Volume II of Qualification Test and Final Program Report consists of the following documents which have been previously submitted and approved by MSFC.

Development Test Report Number - 4918-2 Rev. B

Lot Acceptance Test Report - Number 4918-246 Rev. A

Development Test Procedure - Number DEP 816780 Rev. A

Lot Acceptance Test Procedure - Number ATP 816780 Rev. B

Qualification Test Procedure - Number QTP 816780 Rev. A

DID NO. _____
CDRL NO. _____
P.O. NO. _____
CONTRACT NO. NAS 8-31973

DATA MGR. FILE NO. 4918-2
DEPT FILE NO. _____
ISSUE DATE 11 April 1978
REVISION B
SUPERSEDING A
DATE 1 September 1977

DEVELOPMENT TEST REPORT

FOR

SAFETY AND ARMING DEVICE

MSFC 10A00465

TMc/S PN 816780

PREPARED FOR

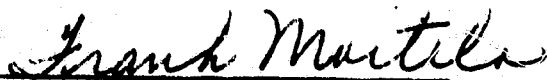
GEORGE C. MARSHALL SPACE FLIGHT CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
HUNTSVILLE, ALABAMA

Teledyne McCormick Selph

3601 UNION ROAD, HOLLISTER, CALIFORNIA 95023



APPROVAL SHEET


Prepared by Frank Mortela
Senior Engineer

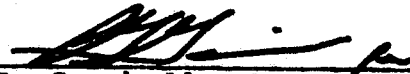

C. E. Campbell, Manager
Ignition & Ballistic Systems

TABLE OF CONTENTS

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE</u>
1.0	INTRODUCTION	1
2.0	PURPOSE AND SCOPE.	1
2.1	PURPOSE.	1
2.2	SCOPE.	1
3.0	TEST SUMMARY	1
3.1	TESTS PERFORMED.	1
3.2	SUMMARY OF RESULTS	2
3.2.1	STRUCTURAL INTEGRITY TEST.	2
3.2.2	EXPLOSIVE TRAIN TESTS.	3
3.2.3	FULL SCALE S&A DEVICES	4
4.0	TEST DESCRIPTION AND RESULTS	5
4.1	GENERAL.	5
4.2	STRUCTURAL INTEGRITY TESTS	5
4.2.1	REQUIREMENT OR CHARACTERISTIC.	5
4.2.2	NUMBER OF TESTS.	5
4.2.3	TEST DESCRIPTION	6
4.2.4	TEST RESULTS	6
4.3	EXPLOSIVE TRAIN TESTS.	6
4.3.1	REQUIREMENT OR CHARACTERISTIC.	6
4.3.2	NUMBER OF TESTS.	7
4.3.3	DESCRIPTION OF TEST AND RESULTS.	7
4.4	FULL SCALE S&A TESTS	11
4.4.1	PURPOSE AND CONFIGURATION.	11
4.4.2	TEST PROCEDURE AND RESULTS	11
5.0	PROBLEMS - CAUSE AND CORRECTIVE ACTION	20
5.1	MONITOR SWITCH ACCURACY.	20
5.1.1	DESCRIPTION OF PROBLEM	20
5.1.2	CORRECTIVE ACTION.	20
5.2	90° CYCLING.	22
5.2.1	DESCRIPTION OF PROBLEM	22
5.2.2	CORRECTIVE ACTION.	22

TABLE OF CONTENTS

(Continued)

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE</u>
5.3	LEAKAGE.	24
5.3.1	DESCRIPTION OF PROBLEM	25
5.3.2	CORRECTIVE ACTION	25

FIGURES

1	EXPLOSIVE TRAIN TEST SETUP	6
2	OSCILLOGRAPH RECORD OF CYCLING TEST.	17
3	FUNCTION TEST SETUP.	18
4	MODIFICATION TO DETENT	23

TABLE

I	FULL SCALE SAFE AND ARM TESTS.	12
---	--	----

PHOTOGRAPHS

1	TYPICAL EXPLOSIVE TRAIN TEST	25
2	S&A - SN0001	26
3	S&A - SN0004	27
4	S&A - SN0002	28
5	S&A - SN0003	29

APPENDICES

A	TEST REPORT 4918-110
B	TEST REPORT 4918-208
C	TEST REPORT 4918-213

DEVELOPMENT TEST REPORT
FOR
SAFETY AND ARMING DEVICE

1.0 INTRODUCTION

This development test report is submitted as Documentation Item Number 11, listed in Table VII of NASA Specification 10A00465. These development tests conducted by Teledyne McCormick Selph (TMc/S) were authorized by Phase II of Scope of Work, Exhibit "A" to NASA-MSFC contract NAS 8-31973.

2.0 PURPOSE AND SCOPE

2.1 PURPOSE

The development tests described herein were conducted by TMc/S as a prerequisite to qualification testing of the Safety and Arming Device, TMc/S PN 816780.

2.2 SCOPE

This document describes the tests performed and the results. It also discusses problems encountered during assembly of the S & A devices and their solutions or corrective actions.

3.0 TEST SUMMARY

3.1 TESTS PERFORMED

The following tests were performed:

<u>Quantity</u>	<u>Test Description</u>
2	Structural Integrity - Two simulated S & A devices were fired in the SAFE position to verify the body and rotor would remain intact without fragmenting.

3.1

TESTS PERFORMED (Continued)

QuantityTest Description

45

Explosive Train Tests - Tests were conducted to demonstrate reliable propagation from the NSI detonator to the CDF line at worst case conditions of explosive load charge weights, temperature, and gaps or misalignment between elements.

4

Full Scale S & A Devices - Units were subjected to radiographic, leak, and electrical tests. Two units (Group I) were subjected to sine and random vibration. Two units (Group II) were subjected to ordnance shock, SRB water landing, and SRB parachute deployment. One unit from each group was then fired at low temperature in the ARMED position, and one from each group was fired at high temperature in the SAFE position.

3.2

SUMMARY OF RESULTS

All tests were successful indicating that the S & A device is ready to be committed to assembly of qualification units.

3.2.1

Structural Integrity Test

There was no fragmentation of the S & A body or rotor when fired in the SAFE position. The NSI detonators remained in the body (not expelled) and there was no decomposition of the test lead (CDF line) explosive.

3.2.2 Explosive Train Tests

Tests were conducted using NSI detonators and CDF lines installed and fired in simulated S & A bodies. All test groups fired successfully.

<u>Group</u>	<u>Quantity</u>	<u>Configuration and Result</u>
I	5	Nominal explosive load and gaps, fired at ambient temperature -- all units propagated, bodies remained intact.
II	5	Nominal explosive load, maximum detonator standoff, fired at -65°F; all units propagated.
III	5	Nominal explosive load, maximum CDF line standoff, fired at ambient temperature; all units propagated.
IV	5	Ten percent (10%) underload of PETN in the explosive lead maximum CDF line standoff, fired at ambient temperature; all units propagated.
V	5	Ten percent (10%) overload of PETN in the explosive lead, normal gaps at interfaces, fired at ambient temperature; all units propagated.
VI	20	Nominal explosive load and standoff, fired at ambient temperature, angular misalignment of explosive lead varied using the Langlie Reliability Test Method for "one-shot items". The test data indicates reliable propagation at angular misalignment up to 22.65° with 99.99 reliability and 25° with 99.9 reliability at 95% confidence level.

3.2.3

Full Scale S&A Devices

Anomalies observed during leak and electrical checkout and corrective action to prevent their recurrence will be discussed later in this report. Units were fired with NSI detonators and single ended CDF lines installed. Units fired in the ARMED position propagated normally and ruptured the aluminum witness tubes. On the SAFE firings, there was no decomposition of the test lead (CDF line) explosive, the body and rotor remained intact, and the NSI detonator remained in place (not expelled).

4.0

TEST DESCRIPTION AND RESULTS

4.1

GENERAL

The S & A device to be supplied for the Space Shuttle SRB is basically the same device previously used on the Saturn V. Changes were kept to a minimum to minimize design and development costs. The changes were: redesign of the explosive lead, reduce the mass of the micro switch actuators by replacing a "heavy" roller type actuator with a lighter weight formed leaf actuator, and modification of the body to withstand the explosive output of the NSI detonator. This last modification was necessary because the NSI detonator scheduled for use in this device has four times the explosive output of the EBW detonator used in the "Saturn" S & A.

The development test plan was designed to emphasize these modifications and the higher level vibration and shock requirements. The test program was conducted in accordance with TMC/S DTP S16780.

"Test lead" and "CDF line" refer to the confined detonator fuze PN 10A00455 supplied by MSFC to be used as witness material.

4.2

STRUCTURAL INTEGRITY TESTS

4.2.1

Requirement or Characteristic

This test was performed to demonstrate compliance with paragraph 3.2.15 of NASA-MSFC 10A00465 that there be no fragmentation of the body or rotor in the case of inadvertent firing of the installed detonator with the rotor in the SAFE position.

4.2.2

Number of Tests

Two units were tested.

4.2.3

Test Description

Each test unit consisted of body, rotor with explosive leads installed, threaded adapters, CDF lines and NSI detonators. A debris retainer was installed to capture small fragments ejected through the vent holes. The NSI detonators and CDF lines were furnished by MSFC. Detonators were fired by the application of 5.0 amperes direct current from a constant current power source.

4.2.4

Test Results

The bodies and rotors remained intact on both test units. The CDF lines were not initiated or even damaged. There was minor smudging of the output ends of the CDF lines by combustion products from the detonators or from the explosive leads which had initiated. The detonators remained in place in the body although there was a gap of approximately 0.015 between the detonator mounting hex and the S & A body. Subsequent sectioning indicated that the threads of the S&A body had yielded slightly but did not fail.

On the first unit fired, the debris retainer separated from the body. It failed at the mounting holes because washers were not used under the mounting bolt heads. Flat washers were installed for the second unit and the retainer remained in place when the device was fired. The test laboratory report, #4918-110, is included as Appendix A of this report.

4.3

EXPLOSIVE TRAIN TESTS

4.3.1

Requirement or Characteristic

The purpose of this test series was to optimize the explosive lead configuration and demonstrate proper functioning at worst case conditions of load weight variations, standoff, misalignment at component interfaces, and temperature limits.

4.3.2 Number of Tests

Forty-five tests were fired in six groups.

4.3.3 Description of Test and Results

This series of tests used the explosive train test setup shown on Figure 1. These test samples used special test bodies, rotors, and sleeves. The NSI detonators and CDF test leads were furnished by MSFC.

For this series of tests the NSI detonators were initiated using the NASA standard firing unit, Model C72-0833, supplied by MSFC. The constant current output was used.

4.3.3.1 Group I - Five Tests

- a. Configuration: The explosive leads had the nominal charge weight. CDF lines and the NSI had normal stand-off distance. Samples were fired at ambient temperature.
- b. Results: The detonators fired, CDF test lines initiated and the cores were completely consumed. Factual data is contained in laboratory test report 4918-208 included as Appendix B of this report.

4.3.3.2 Group II - Five Tests

- a. Configuration: The test parameter was initiation of the explosive lead in the rotor at worst case standoff of the detonator. The .060 inch thick washers under the hex of the detonator produced the desired standoff. The explosive lead charge weight was nominal. Samples were fired at -65°F.
- b. Results: Detonators fired, explosive leads initiated and the CDF test leads were initiated with the core completely consumed.

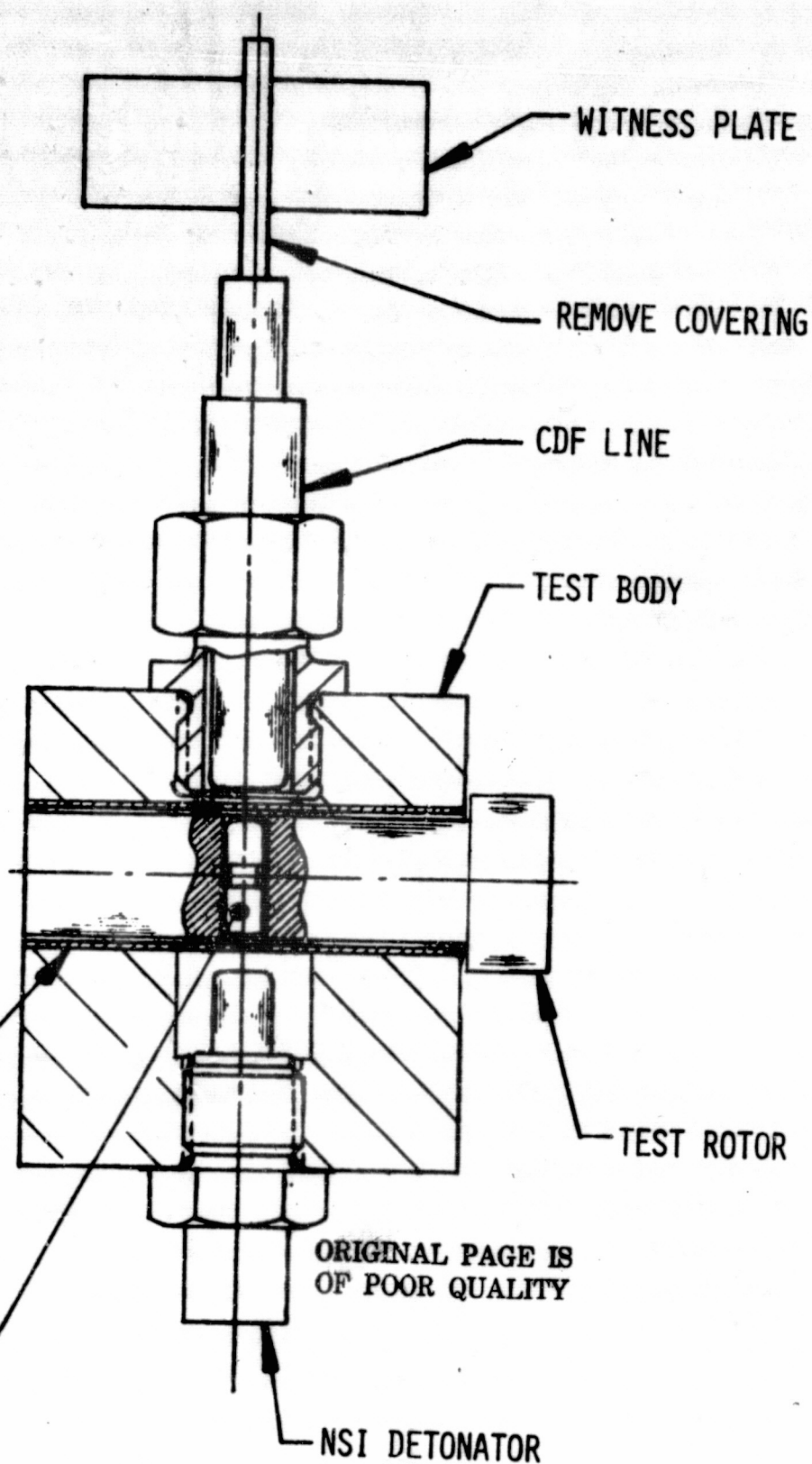
ROTOR MAY BE
ROTATED FOR
ANGULAR
DISPLACEMENT

SLEEVE

EXPLOSIVE LEAD

EXPLOSIVE TRAIN TEST SETUP

FIGURE 1



4.3.3.3 Group III - Five Tests

- a. Configuration: The test parameter was initiation of the CDF test lead at worst case standoff between the explosive lead of the rotor and the tips of the CDF lines. Worst case standoff allowed by component tolerance was simulated using shims under the hex of the adapter bushings in which the CDF lines are installed. The explosive charge weight was normal. Samples were tested at room ambient temperature.
- b. Results: The CDF test leads were initiated and detonated high order.

4.3.3.4 Group IV - Five Tests

- a. Configuration: This group was tested to demonstrate reliable initiation of the CDF test lead with 10% (by weight) underload of the pressed PETN charges within the explosive leads. The PETN charge is pressed to a length (TMC/S drawing 817330) in order to control overall length of the explosive lead. We determined that .062 grams of PETN produced the nominal load height for Groups I through III. For this group the PETN weight was .056 grams or 10% under nominal.
- b. Results: All samples propagated and produced high order detonation of the CDF test lead explosive core.

4.3.3.5 Group V - Five Units

- a. Configuration: This group was tested to demonstrate that the explosive lead would initiate properly with a 10% overload of the pressed PETN charges. PETN weight in each shell was .068 grams. Both the detonator and CDF test lead standoffs were normal. Test temperature was room ambient.

4.3.3.5 Group V - Five Units (continued)

- b. Results: The samples functioned normally. CDF test leads initiated high order. There was no fragmentation of the rotor or body.

4.3.3.6 Group VI - Twenty Units

- a. Configuration: The purpose of this test group was to determine the maximum angular misalignment of the rotor (to the NSI detonator and the CDF ports) for reliable propagation. The misalignment was adjusted and the results developed using the Langlie Reliability Test Method for "one shot items". Criteria for a "fire" was high order initiation of the CDF test lead explosive core.

For this test the explosive lead charge weights and detonator and CDF test lead standoffs were normal. Test temperature was room ambient.

- b. Results: The raw data and interpretation are presented on pages 9, 10, and 11 of Report Number 4918-208 in Appendix B. Photograph Number 1 shows a typical test sample after firing.

The 50% firing point was at 35.6 misalignment. The preliminary and weighted standard deviation (σ) are 1.409° and 1.806° respectively. The weighted σ adjusts for possible inaccuracies due to the limited sample size. The graphical representation shows a 99.99 probability of firing at 95% confidence level of 22.65°. The plot also shows a 99.99 probability (95% confidence) against firing at 48.5° which means a 41.5° margin against inadvertent firing in the SAFE position.

4.3.3.7 Groups I through VI - Review and Analysis

A review of test results for this test series indicates that the redesigned explosive lead will provide reliable initiation of the installed CDF lines when initiated by the NSI detonator at worst case conditions of explosive load weight variations, low temperature, and standoff (gap) at the detonator/explosive lead and explosive lead/CDF interfaces.

The results of test Group VI also indicate a very high probability of propagation at extreme angular misalignment of the rotor with the detonator and CDF ports.

4.4 FULL SCALE S&A TESTS

4.4.1 Purpose and Configuration

Testing was performed on four fully assembled S&A devices to verify that the design would meet basic environmental and performance requirements of the product specification before committing the unit to the qualification program.

TMc/S assembled four S&A devices to drawing 816780, associated subassembly and detail drawings, and "Assembly and Inspection Procedure 816780". Some areas of nonconformance with the various documentation were revealed during the assembly and checkout of the devices. These will be discussed in detail in Section 5.0 of this report.

4.4.2 Test Procedure and Results

The S&A devices were tested in accordance with Table I, which summarizes these tests for convenient reference.

TABLE I

FULL-SCALE SAFE AND ARM TESTS

Type Test	DTP816780 Paragraph	Test Quantity & Sequence	
		Group I	Group II
Examination of product	5.1	2	2
X-Ray	5.2	2	2
N-Ray	5.3	2	2
Leak	5.4	2	2
Ambient Temperature Electrical Checkout	8.1	2	2
Sinusoidal Vibration	8.2	2	
Random Vibration	8.3	2	
Shock	8.4		2
Leak	5.4	2	2
Low Temperature Function --Armed	8.5	1	1
High Temperature Function --Safe	8.5	1	1

4.4.2.1 Examination of Product

Components, subassemblies, and the completed S&A devices were examined for dimensions, workmanship, use of proper material and finishes, and absence of visible defects. The units were in compliance with all important areas.

4.4.2.2 X-Ray Examination

The S&A devices were subjected to x-ray inspection in accordance with 5.2 of DTP 816780. The radiographs were not a significant inspection tool because the many component parts effectively masked each other to the extent that it was difficult to clearly identify the many features. No anomalies could be found so the units were acceptable.

4.4.2.3 N-Ray Examination

The explosive lead assemblies, Part Number 817178, and the complete S&A devices were subjected to neutron radiographic examination in accordance with 5.3 of DTP 816780. The radiographs of the explosive leads clearly showed the explosive charges. Inspection was able to verify that there were no charge density variations, gaps between charges or other abnormalities.

The radiograph of the complete S&A devices showed the various components more clearly than the x-ray radiographs. However it was still difficult to fully identify the various components. Careful examination failed to reveal any out of place components, contamination, or any other abnormalities so the units were acceptable.

4.4.2.4 Leak Test

The S&A devices were subjected to a leakage test per paragraph 5.4 of DTP 816780. The test involved submerging the units under water after the air pressure above the water had been reduced to the

4.4.2.4 Leak Test (Continued)

equivalent of 61,000 feet altitude. The devices were observed for leakage indicated by a continuous release of a stream of or a growth of bubbles.

During the initial leak test there was evidence of leakage at the roll (spring) pins which are used to pin the housing to the flange of the body. The roll pins, which had been pressed in only half their length, were extracted and the housings removed. Sealing compound applied to the faying surfaces of body and housing was cleaned off, fresh sealant was applied and the housings reassembled to the bodies. Sealant was cured and the units resubmitted to the leakage test. One of the four units still showed leakage at one point on the housing to body interface. This unit together with two others which had a test anomaly during electrical checkout were again disassembled and reworked. Rework will be discussed later in this report. These three units were subsequently leak tested again and were acceptable.

4.4.2.5 Ambient Temperature Electrical Checkout

The four S&A devices were subjected to ambient temperature electrical checkout in accordance with paragraph 8.1 of DTP 816780. The testing included operational cycling tests at 24, 28, and 32 Vdc and various circuitry tests. The circuitry tests were performed without incident. However, during the 90° rotation test, two units failed to meet the test requirement. Specifically the arm monitor circuits failed to indicate an ARMED condition within .250 seconds. Analysis of the recorder traces suggested that the rotor did not lock in the ARMED position. The most probable cause was failure of the rotor to rotate far enough for the detent to engage. These units were subsequently disassembled, reworked, and reassembled. They were retested and operated properly at all three voltages.

4.4.2.6 Sinusoidal Vibration

The S&A devices were delivered to Approved Engineering Test Laboratories in Fullerton, California for environmental testing. Two of the units, S/N 0001 and S/N 0002, were subjected to sinusoidal vibration in accordance with paragraph 8.2 of DTP 816780. The monitor switch circuits of the devices were visually monitored during vibration using specially constructed test boxes with indicator lamps which would be turned on if the rotor of the device rotated far enough to activate the microswitches. There was no indication of rotor rotation during the test. The devices were cycled from SAFE to ARM to SAFE at the end of the test. Both units cycled within .250 seconds and indicated proper rotor position. Factual data is reported on pages 5 through 7 AETL Report Number 773-2209 which is included as Appendix C of this report. For this report the test axes are:

- X = Longitudinal
- Y = Transverse - perpendicular to a plane through the detonator and CDF ports.
- Z = Transverse - parallel to a plane through the detonator and CDF ports

4.4.2.7 Random Vibration

Two units, S/N 0001 and S/N 0002, were also subjected to random vibration in accordance with paragraph 8.3 of DTP 816780. This was the same three phase (lift-off, boost, re-entry) vibration schedule which will be imposed on the qualification program except that only Mission 1 duration was used. The monitor switch positions were monitored during the test as described for the sine vibration. There was no indication of rotor rotation during vibration. The units were cycled from SAFE to ARM to SAFE after each axis of vibration. The devices cycled within .250 seconds and switches indicated proper position. Factual test data on this test is reported on pages 8 through 32 of AETL Report Number 773-2209. A photograph of a typical setup is found on page 67 of the AETL report.

4.4.2.8 Shock

Two units, S/N 0003 and S/N 0004, were subjected to Ordnance Shock, SRB Water Landing and SRB parachute deployment shock per paragraph 8.4 of DTP 816780. This is the same shock schedule to be tested in qualification except that only mission duration was used. The ordnance shock was performed on the vibration machine. Factual data on this test is reported on pages 33 to 44 of AETL Report Number 773-2209.

The SRB water landing and parachute deployment shock tests were performed using a drop tower. Factual data is reported on pages 45 through 62 of AETL report. The switch positions were monitored during the test. There was no evidence of rotor rotation. The units were cycled from SAFE to ARM to SAFE after each axis of test. The devices cycled within .250 seconds and switches indicated proper rotor position. The actual time for 90° rotation was typically 40-50 milliseconds. A strip chart recorder was used to record the cycling. A typical section of this record is shown in Figure 2 of this report.

4.4.2.9 Leak Test

At the conclusion of shock vibration testing at AETL the units were returned to TMC/S for leak and firing tests. The units were again subjected to the leakage test per paragraph 5.4 of DTP 816780. Two units, S/N 0002 and S/N 0003 showed leakage at one of the roll pins. S/N 0001 and 0004 showed no leakage.

4.4.2.10 Low Temperature Function - ARMED

S/N 0001 from the vibration test group and S/N 0004 from the shock test group were tested per paragraph 8.5 of DTP 816780. These units were tested for propagation of the CDF test lead in the ARMED position at +20°F. The NSI detonators, CDF test leads, and witness tubes were installed and arranged per Figure 3 of this report. The two detonators in each device were fired simultaneously using capacitor discharge output positions 1 and 2 of the MSFC supplied standard firing unit.

ORIGINAL PAGE IS
OF POOR QUALITY

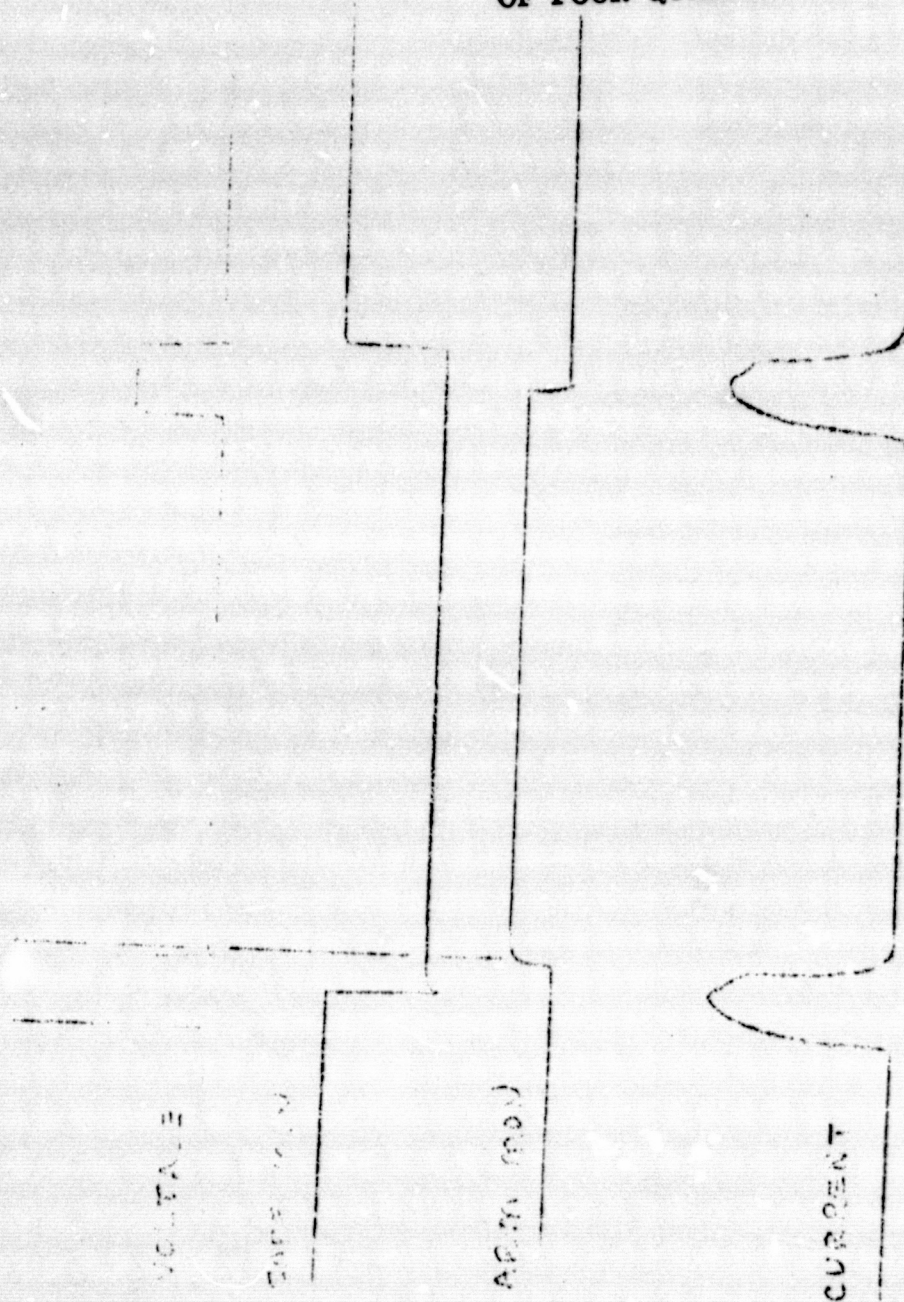


FIGURE 2

OSCILLOGRAPH RECORD OF CYCLING TEST
(SAMPLE)

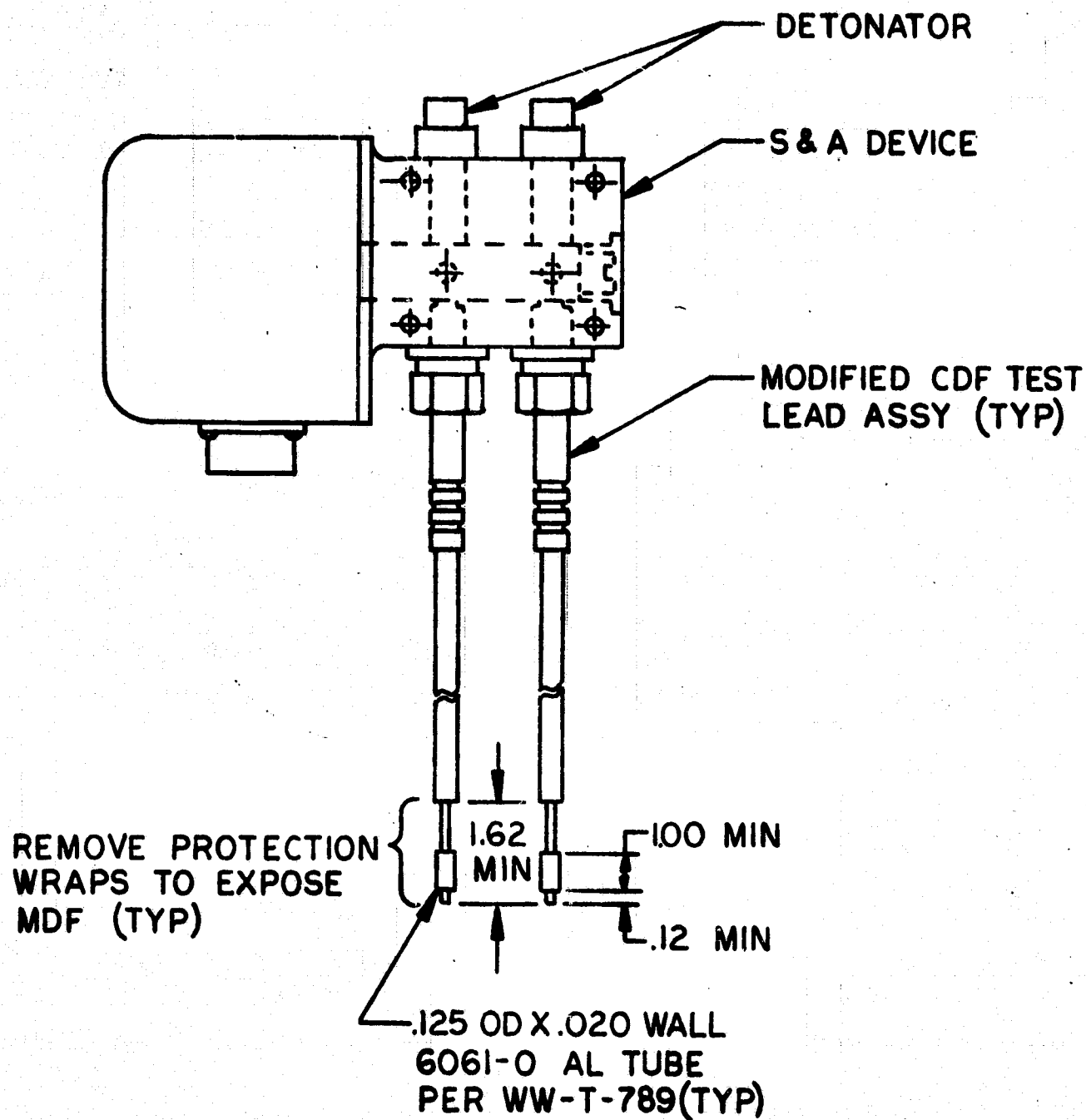


FIGURE 3
FUNCTION TEST SETUP

4.4.2.10 Low Temperature Function - ARMED (Continued)

Both S&A devices fired successfully. Each of the two explosive leads transferred the detonation to the CDF lines, the CDF line explosive cores were completely consumed, and the aluminum witness tubes were completely fragmented indicating high order detonation. On S/N 0004 the detonator on the housing end was ejected from the port. The body threads appear to have failed. This condition was of course not a test anomaly since the only requirement for firing in the ARMED position is high order propagation. Photographs 2 and 3 show these units after firing.

4.4.2.11 High Temperature Function - SAFE

S/N 0002 from the vibration test group and S/N 0003 from the shock test group were tested per paragraph 8.5 of DTP 816780. These units were tested to demonstrate that the CDF test leads would not be initiated and that the rotor and body would not fragment if the installed NSI detonators were inadvertently fired with the device in the SAFE position. Test temperature was +165°F. The test setup was per Figure 3. For this test the debris retainers MSFC P/N 10A00487 were installed. The detonators were fired using the capacitor discharge outputs of the standard firing unit.

Both units fired successfully. The CDF test leads were not initiated, the body and rotor remained intact, the detonators were not expelled, and the debris retainer remained in place and was not perforated by fragments ejected through the vent holes. Photographs 4 and 5 show these units after firing.

5.0

PROBLEMS - CAUSE AND CORRECTIVE ACTION

Some problems were experienced during the assembly and test of the four S&A devices. Their cause and recommended corrective action are discussed herein.

5.1

MONITOR SWITCH ACCURACY

5.1.1

Description of Problem

TMc/S requested MSFC concurrence to use the monitor switches to monitor rotor position during dynamic testing. We had expected these switches to actuate within 7.5° of rotor rotation from the SAFE or ARM positions based on analysis of the component dimensions and expected operation. MSFC agreed to the proposal contingent upon testing to demonstrate maximum angle of reliable propagation and measurement of switch play for development and qualification units. Switch play was measured during the assembly of the four devices for the development test program. The angles measured from 5° to 15° in the "+" direction (direction of rotation) and 4° to 12° in the "-" direction. The apparent discrepancy between predicted and the actual operation appears to be due to the component dimension tolerance variations which were not considered and normal assembly tolerances, particularly regarding adjustment of the microswitches and spring leaf actuators. TMc/S drawing 817331 for the spring actuator allowed $\pm 5^\circ$ variation on a formed angle. This appears to have been excessive and contributed to the subject condition. The actuator was formed from a straight leaf actuator using soft development tooling.

5.1.2

Corrective Action

Explosive train test Group VI described in paragraph 4.3.3.6 of this report demonstrates that the device will propagate reliably over a wide range of angular misalignment of the rotor. The angle for 99.99 percent probability of firing (at 95% C.F.) was 22.65°. The angle for 99.99 probability of firing is even greater at 25°.

5.1.2 Corrective Action (Continued)

TMc/S has constructed new tooling to form the 817331 actuator. On actuators for qualification and future production units we will be able to hold the 45° angle to $^{+3}_{-2}$ instead of $\pm 5^\circ$. Further improvement in switch play is expected due to refined adjustment techniques. Switch play will be reduced to 7.5° . An in-process inspection assures that when the rotor is held in the "ARM" position by the detent that the explosive leads are aligned with the detonator and CDF ports within $\pm 2.5^\circ$.

Drawing analysis indicates the rotor rotation required to overcome the detent is 17° in the direction of rotation and 13° in the reverse direction. Actual measurement on a device was 16° in the forward direction. The reverse direction was not measured since the device is not subject to auto-rotation in the reverse direction. Analysis of the data, measurements, and controls indicates that:

- a. The monitor switches will detect variations in rotor position much less than actually required to overcome the detent, 7.5° versus 17° .
- b. The monitor switches will detect explosive train misalignment of 10° ($7.5^\circ + 2.5^\circ$) or less which compares to 25° for reliable propagation. In any unit there is a wide margin of safety in terms of monitoring the actual position and in reliable propagation. Therefore, TMc/S can confidently use the monitor switches to monitor rotor position during dynamic testing.

TMc/S proposes to measure and record switch play during assembly of the qualification units and to monitor rotor position using the SAFE and ARM monitor switches during qualification testing. In any event the monitor switches will detect rotor rotation sufficient to overcome the detent before such rotation is sufficient to cause failure to propagate. There appears to be a 100% margin between the angle of switch play and the angle of control of the detent and an even greater margin of 200% between the angle of switch play and angle of reliable propagation.

5.2 90° CYCLING

5.2.1 Description of Problem

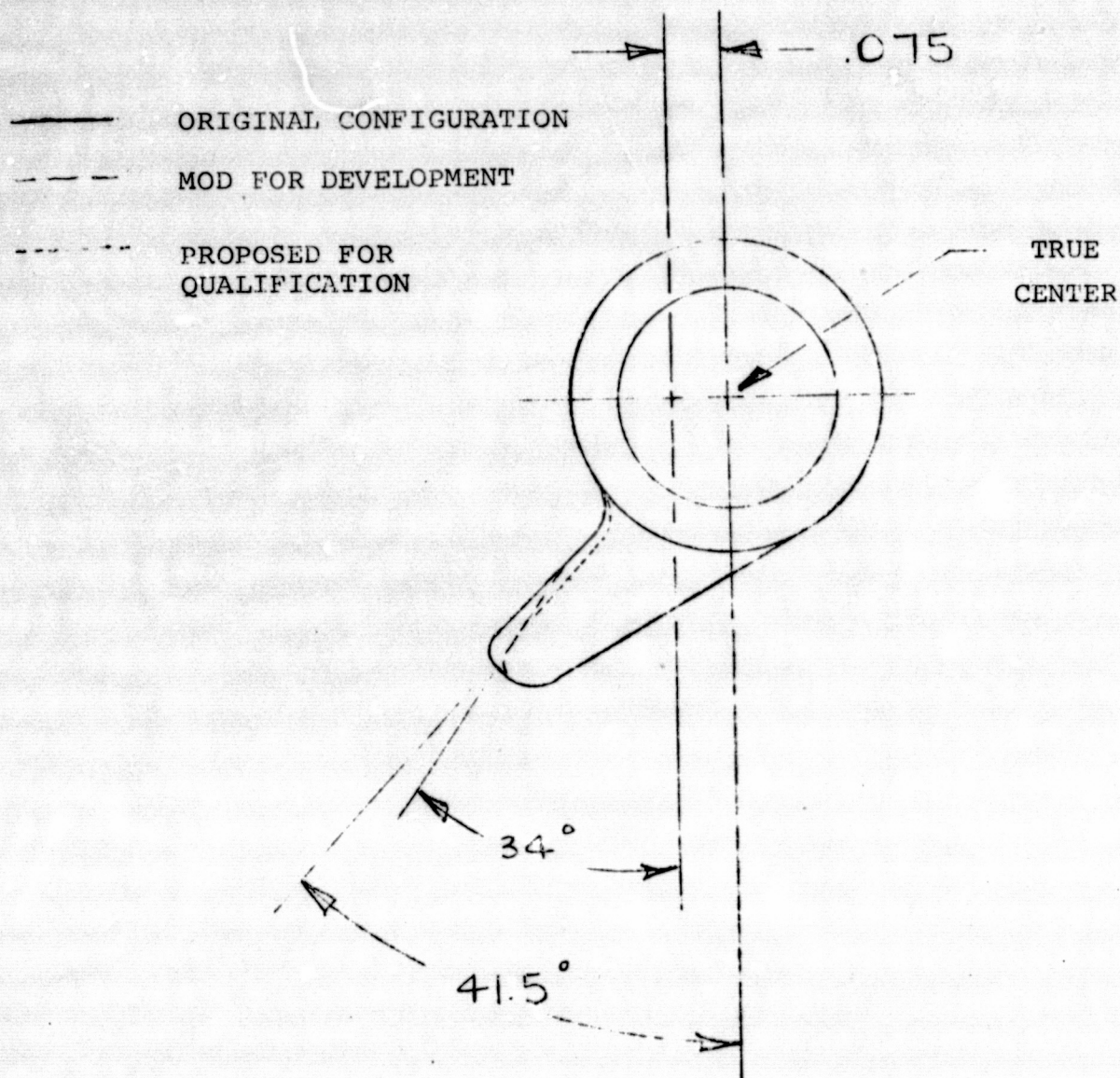
During ambient temperature electrical checkout prior to dynamic testing two of the four S&A devices malfunctioned when cycled at 32 Vdc input to the solenoid. These two units together with the unit which failed the leakage test were returned to production for rework.

The housings were removed and the action of the solenoid, rotor, and detent were studied closely while the solenoid was rotated slowly manually (not electrically). It was observed that the arm of the driving clutch would engage the arm of the detent before the drive train had rotated its full 90° cycle. At the time of contact the grooved detent position of the rotor was not yet under the detent roller. The result was that the solenoid rotation was being stopped short of its full travel and the detent was not engaging and locking the rotor in position. Therefore, the rotor was depending on inertia to complete the 90° rotation and on the detent spring to stop and hold it in the correct position. The malfunction occurred when the rotor inertia overcame the detent spring and the rotor rotated beyond 90° coming to rest about 5° past the proper position with the detent roller resting on the outermost surface of the rotor.

5.2.2 Corrective Action

Corrective action was to modify the detents by removing some material from the arm. Thereby the solenoid/driving clutch could rotate an additional 3.5° before engaging the detent. The units were re-assembled and operated properly thereafter. The modification to the detent is illustrated on Figure 4.

ORIGINAL PAGE IS
OF POOR QUALITY



DETENT CONFIGURATION

FIGURE 4

5.3

LEAKAGE

5.3.1

Description of Problem

The S&A devices had required rework to meet the leakage test initially. Two units subsequently failed again after shock and vibration testing. In each case the leakage was at the housing to body seal area. The problem appears to be excessive gap between the faying surfaces of the body and housing. The actual dimensions were:

Housing I.D.	3.142 - - - - -	3.154
Body O.D.	3.120 - - - - -	3.116
Total Clearance	.022 - - - - -	.038
Diametrical Clearance	.011 - - - - -	.019

These units therefore required a thick coating of sealant and depended on the sealant for mechanical strength as well. The heavy adhesive film is more subject to leakage paths than a thinner film would be.

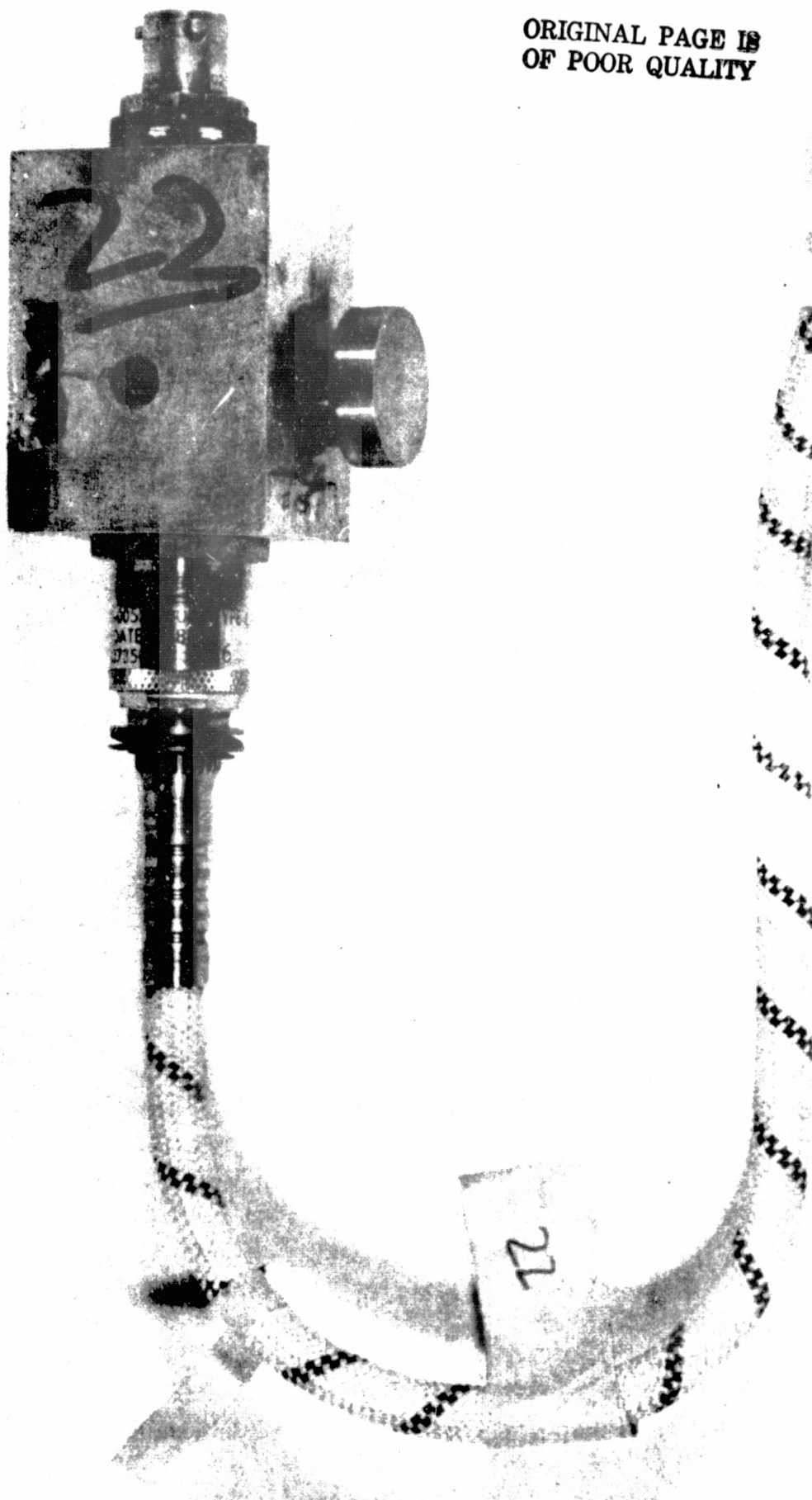
5.3.2

Corrective Action

The following corrective action will be implemented:

- a. Increase the number of spring pins used to pin the housing to the body from four to six. This change will be incorporated starting with the qualification lot.
- b. Re-dimension the body to reduce the clearance between body and housing. This change would be made to the drawing at this time but the effectivity would be on future procurements. The bodies scheduled for use on the qualification devices will be reworked by bonding (epoxy) thin aluminum strips to the diameter and the straight section to bring them up to the new dimension. The strips will be formed from 6061-0 aluminum alloy. The epoxy will be 3-M Company EC-2216 per WS3309 or a material meeting MMM-A-134, Type II.

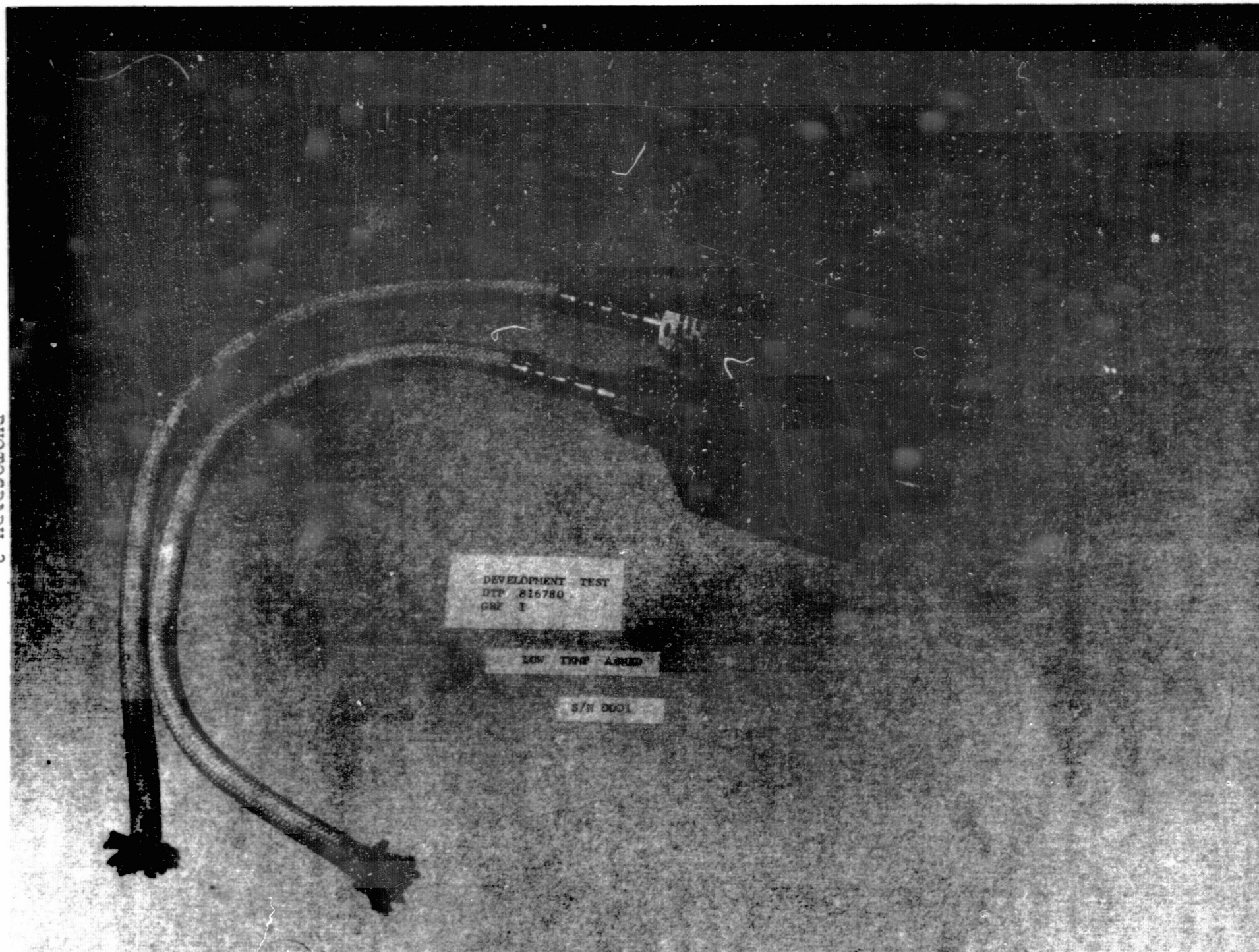
ORIGINAL PAGE IS
OF POOR QUALITY



PHOTOGRAPH 1
-25-

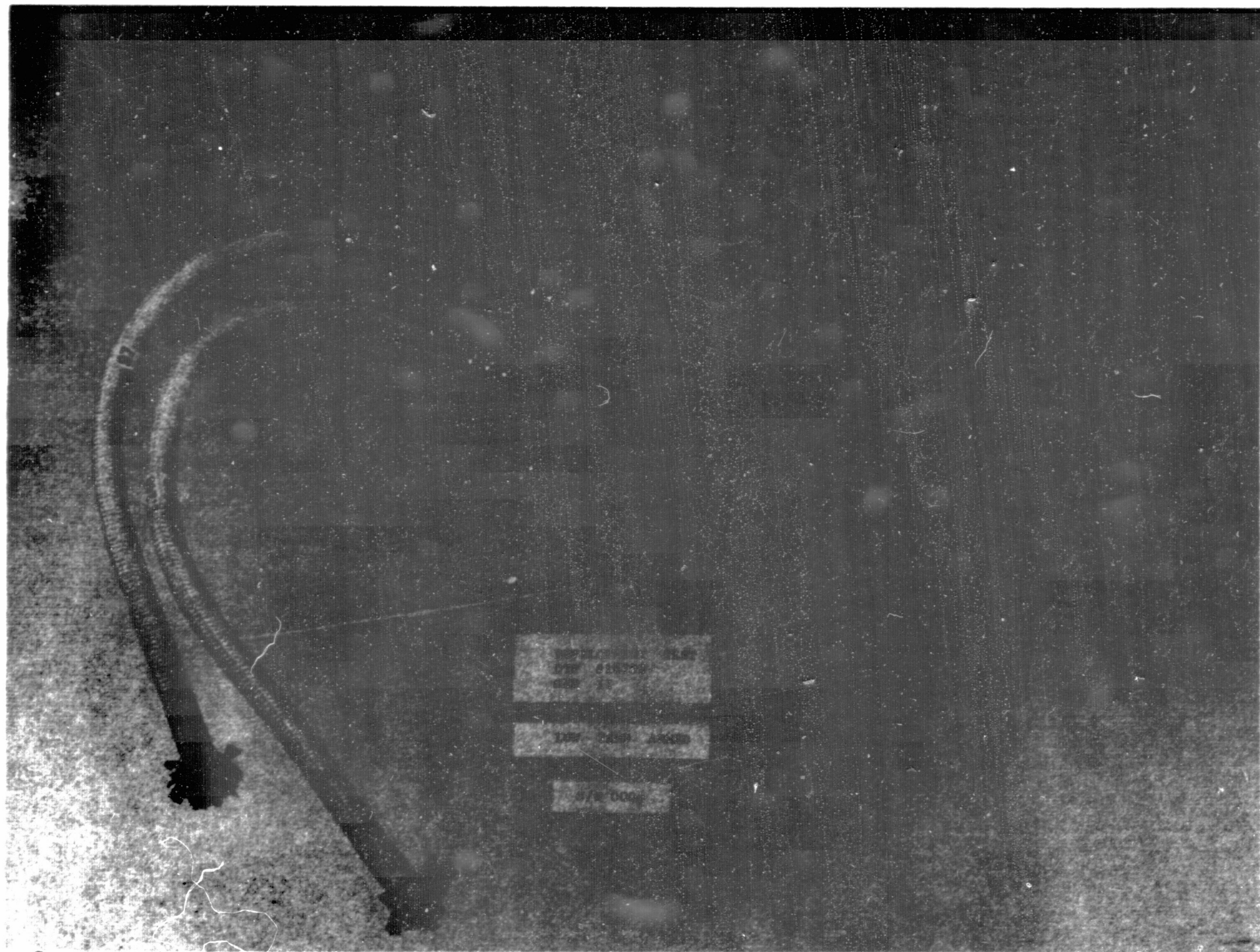
11-19

PHOTOGRAPH 2



630 A1...

PHOTOGRAPH 3



83014

PHOTOGRAPH 4
-28-

DEVELOPMENT TEST
DTP 816780
GRP 1

HIGH TEMP SAFE

S/N 0002

030 X2

ORIGINAL PAGE IS
OF POOR QUALITY

DEVELOPMENT TEST
DTP 816780
GRP II

HIGH TEMP SAFE

8/10 0003

PHOTOGRAPH 5

-29--

636 3

APPENDIX A

TEST REPORT 4918-110
STRUCTURAL INTEGRITY TEST

DEVELOPMENT	TEST REPORT	JOB NO. 4918-78-110
TMCS DRAWING NO. 816780 MODIFIED		REPORT NO. 4918-110
CUST. DRAWING NO. 10A00465 MODIFIED		LOT NO. N/A
ITEM SAFETY AND ARMING DEVICE		

	TEST PERFORMED BY
	TELEDYNE MCCORMICK SELPH HOLLISTER, CALIFORNIA
	TEST AUTHORIZED BY
	MARSHALL SPACE FLIGHT CENTER
	P. O. No.: NAS8-31973

	DATE	SIGNATURE
TEST ENGINEER	12-1-76	<i>Harry Lowe</i>
PROJECT ENGINEER	12-1-76	<i>Frank Mortela</i>
RELIABILITY	12-1-76	<i>H. A. Dixon</i>
FINAL RELEASE TEST DATA SECTION	12/2/76	<i>Harry Lowe</i>



TELEDYNE McCORMICK SELPH

JOB NUMBER 4918-78 W.O. 110

REPORT NUMBER 4918-110

DATE 1 DECEMBER 1976

PURPOSE OF TEST

LOT ACCEPTANCE ☐

DEVELOPMENT ☒

PREPROD/ PERIODIC / QUAL ☐

ENG. EVALUATION ☐

PRELOAD ☐

FAILURE ANALYSIS ☐

PERFORMANCE INSTRUCTIONS

PERFORM STRUCTURAL INTEGRITY TEST PER PARAGRAPH 6.0 OF DTP 816780
(PRELIMINARY UNRELEASED).



TELEDYNE McCORMICK SELPH

JOB NUMBER 4918-78 W.O. 110

REPORT NUMBER 4918-110

DATE 1 DECEMBER 1976

PURPOSE OF TEST

LOT ACCEPTANCE ☐

DEVELOPMENT ☒

PREPROD/ PERIODIC / QUAL ☐

ENG. EVALUATION ☐

PRELOAD ☐

FAILURE ANALYSIS ☐

PERFORMANCE INSTRUCTIONS

PERFORM STRUCTURAL INTEGRITY TEST PER PARAGRAPH 6.0 OF DTP 816780
(PRELIMINARY UNRELEASED).

TEST SUMMARY SHEET

JOB NUMBER 4918-78-110

REPORT NUMBER 4918-110

TMc/S PART NUMBER 816780 MODIFIED

(PRELIMINARY UNRELEASED) DATE TEST INITIATED 27 OCTOBER 1976

CUSTOMER SPECIFICATION N/A

TMc/S PROCEDURE DTP 816780

DATE TEST COMPLETED 27 OCTOBER 1976

TYPE OF TEST	② REFERENCE PARAGRAPH	MEASURED VALUES		NUMBER OF UNITS		REMARKS AND/OR UNTOWARD INCIDENTS
		MINIMUM	MAXIMUM	TESTED	ACCEPTED	
STRUCTURAL INTEGRITY	6.0	N/A	N/A	2	2	NONE
ORIGINAL PAGE IS OF POOR QUALITY						

Reference paragraphs ① Customer Specification ② TMc/S Procedure



TELEDYNE McCORMICK SELPH

Hollister, Calif. • 95023

TEST REPORT

JOB NUMBER 4918-78 WO. 110

REPORT NUMBER 4918-110

DATE 1 DECEMBER 1976

EQUIPMENT LIST

ITEM NO.	NAME	MANUFACTURER	MODEL	ACCURACY	CALIBRATION DUE DATE
1	POWER SUPPLY	PERKINS TVCR-040	15	N/A	N/A



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR

REPORT NUMBER 4918-110

DATE 27 OCTOBER 1976

JOB NUMBER 4918-78

W.O. NUMBER 110

TMc/S PART NAME SAFE AND ARM DEVICE

TMc/S DWG. NUMBER 816780 MODIFIED

CUSTOMER SPECIFICATION N/A

TMc/S PROCEDURE ATP 816780 REV. N/C

TEST EQUIPMENT ITEM NUMBERS 1

REQUIREMENTS WHEN THE NSI DETONATOR IS INSTALLED INTO THE S & A BODY AND FIRED WITH THE ROTOR IN THE "SAFE" POSITION THERE SHALL BE NO FRAGMENTATION OF THE BODY OR ROTOR.

CUSTOMER PART NUMBER N/A

UNIT NUMBER	DET 1 SERIAL NUMBER	DET 2 SERIAL NUMBER	BRIDGEWIRE RESISTANCE (OHMS)		TEST EVALUATION
			DET 1	DET 2	
1	142WAA	152WAA	1.05	1.08	Debris Shield separated from body, Detonators retained in body, End Cap separated from body, CDF Line intact - not initiated or decomposed.
2	0103WAA	0147WAA	1.02	1.08	Debris Shield remained in place but slightly deformed. Detonators remained in body, end cap expelled, CDF Lines intact, not initiated or decomposed.
					NOTE: BODY THREADS YIELDED ON DETONATOR SIDE APPROXIMATELY .015. EXPLOSIVE LEADS DETONATED. SOME MINOR SMUDGING OR BURN RESIDUE DEPOSITED ON FACE ON CDF LINES.
					SERIAL NUMBER OF CDF LINES UNIT #2, 8537, 6148 UNIT #1, 8345, 6148

L. Takehana

TECHNICIAN

N/A

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S _____

APPENDIX B

TEST REPORT 4918-208
EXPLOSIVE TRAIN TESTS

ORIGINAL PAGE IS
OF POOR QUALITY

DEVELOPMENT	TEST REPORT	JOB NO.	4918-78-208
TMCS DRAWING NO.	816780	REPORT NO.	4918-208 REV. A
CUST. DRAWING NO.	10A00465	LOT NO.	N/A
ITEM	EXPLOSIVE TRAIN CONFIGURATION		

	TEST PERFORMED BY TELEDYNE MCCORMICK SELPH HOLLISTER, CALIFORNIA
	TEST AUTHORIZED BY NASA/MSFC P.O. NO.: NAS8-31973

	DATE	SIGNATURE
TEST ENGINEER	4-19-77	<i>[Signature]</i>
PROJECT ENGINEER	7-14-77	<i>Frank Martels</i>
RELIABILITY	7/14/77	<i>W. D. Dyer</i>
FINAL RELEASE TEST DATA SECTION	7/14/77	<i>Reggie Dyer</i>

 TELEDYNE McCORMICK SELPH

JOB NUMBER 4918-78 W.O. 208

REPORT NUMBER 4918-208

DATE 15 APRIL 1977

PURPOSE OF TEST

LOT ACCEPTANCE ☐

DEVELOPMENT ☒

PREPROD/ PERIODIC / QUAL ☐

ENG. EVALUATION ☐

PRELOAD ☐

FAILURE ANALYSIS ☐

PERFORMANCE INSTRUCTIONS

45 EACH UNITS TESTED - EXPLOSIVE TRAIN CONFIGURATION PER TABLE I OF
DTP 816780 REVISION N/C

TEST SUMMARY SHEET

 JOB NUMBER 4918-78-208

 REPORT NUMBER 4918-208

 TMC/S PART NUMBER 816780

 DATE TEST INITIATED 3 FEBRUARY 1977

 DATE TEST COMPLETED 16 MARCH 1977

 CUSTOMER SPECIFICATION 10A00465 "A" TMC/S PROCEDURE DTP 816780 REV. N/C

TYPE OF TEST	① REFERENCE PARAGRAPH	MEASURED VALUES		NUMBER OF UNITS		REMARKS AND/OR UNTOWARD INCIDENTS
		MINIMUM	MAXIMUM	TESTED	ACCEPTED	
EXPLOSIVE TRAIN CONFIGURATION	TABLE I	N/A	N/A	45	45	NONE
PROPAGATION	GROUP I	N/A	N/A	5	5	NONE
PROPAGATION	GROUP II	N/A	N/A	5	5	NONE
PROPAGATION	GROUP III	N/A	N/A	5	5	NONE
PROPAGATION	GROUP IV	N/A	N/A	5	5	NONE
PROPAGATION	GROUP V	N/A	N/A	5	5	NONE
RELIABILITY TEST	GROUP VI	27.0°	40.5°	20	20	NONE

Reference paragraphs ① Customer Specification ② TMC/S Procedure



TELEDYNE McCORMICK SELPH

Hollister, Calif. • 95023

TEST REPORT

JOB NUMBER 4918-78 WO. 208

REPORT NUMBER 4918-208

DATE 15 APRIL 1977

EQUIPMENT LIST

ITEM NO.	NAME	MANUFACTURER	MODEL	ACCURACY	CALIBRATION DUE DATE
1	STANDARD FIRING UNIT	FRANKLIN INSTITUTE	C72-0833	N/A	N/A



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR

EXPLOSIVE TRAIN CONFIGURATION TEST

REPORT NUMBER 4918-208

DATE 3 FEBRUARY 1977

JOB NUMBER 4918-78

W.O. NUMBER 208

TMc/S PART NAME EXPLOSIVE TRAIN CONFIGURATION

TMc/S DWG. NUMBER 816780

CUSTOMER SPECIFICATION 10A00465 REV. A

TMc/S PROCEDURE DTP 816780 REV. N/C

TEST EQUIPMENT ITEM NUMBERS 1

REQUIREMENTS UNITS SHALL TRANSFER INITIATION AND REMAIN INTACT.

CUSTOMER PART NUMBER N/A

GROUP NUMBER 1 - NOMINAL CONFIGURATION

(A)

UNIT NUMBER	CDF SERIAL NUMBER	NSI DETONATOR SERIAL NUMBER	DETONATOR/ EXPLOSIVE LEAD GAP	EXPLOSIVE LEAD/ CDF GAP	TEST TEMP.	EVALUATION
2	8687	00115	Normal	Normal	Amb.	Units transferred Initiation
3	8550	00240	↓	↓	↓	↓
4	8336	00102				
8	8685	00141				
9	8355	00126				

- NOTES: (1) CDF Cores completely consumed
(2) Rotors backed-out to various degrees
(3) All bodies remained intact

J. Pena
TECHNICIAN

N/A
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
EXPLOSIVE TRAIN CONFIGURATION TEST

REPORT NUMBER 4918-208

DATE FEBRUARY 1977

JOB NUMBER 4918-78

W.O. NUMBER 208

TMC/S PART NAME EXPLOSIVE TRAIN CONFIGURATION

TMC/S DWG. NUMBER 816780

CUSTOMER SPECIFICATION 10A00465 REV. A

TMC/S PROCEDURE DTP 816780 REV. N/C

TEST EQUIPMENT ITEM NUMBERS 1

REQUIREMENTS UNITS SHALL TRANSFER INITIATION AND REMAIN INTACT.

CUSTOMER PART NUMBER N/A

GROUP NUMBER 2 - EXPLOSIVE STAND-OFF

(A)

UNIT NUMBER	CDF SERIAL NUMBER	NSI DETONATOR SERIAL NUMBER	DETONATOR/ EXPLOSIVE LEAD GAP	EXPLOSIVE LEAD/ CDF GAP	TEST TEMP.	EVALUATION
1	8546	00113	0.060 IN. ↓	Normal ↓	-65°F ↓	UNITS TRANSFERRED INITIATION ↓
5	8685	00151				
6	8359	00143				
7	8538	00280				
10	8545	00062				

- NOTES: (1) CDF Cores completely consumed
(2) Rotors back-out to various degree
(3) All bodies remained intact.

* .060 THICK WASHERS WERE PLACED UNDER DETONATOR HEX TO PRODUCE EXCESS STAND-OFF. NORMAL STAND-OFF LIMITS ARE: .1075-.1675. EXCESS STAND-OFF WAS FROM .000-.060 INCHES.

(A)

J. Pena
TECHNICIAN

N/A
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR

EXPLOSIVE TRAIN CONFIGURATION TEST

REPORT NUMBER 4918-208 DATE 15 MARCH 1977
JOB NUMBER 4918-78 W.O. NUMBER 208
TMC/S PART NAME EXPLOSIVE TRAIN CONFIGURATION TMC/S DWG. NUMBER 816780
CUSTOMER SPECIFICATION 10A00465 REV. A TMC/S PROCEDURE DTP 816780 REV. N/C
TEST EQUIPMENT ITEM NUMBERS 1
REQUIREMENTS UNITS SHALL TRANSFER INITIATION AND REMAIN INTACT.

CUSTOMER PART NUMBER N/A

GROUP NUMBER 3 - EXPLOSIVE STAND-OFF

(A)

IN LINE LEAD POSITION

UNIT NUMBER	CDF SERIAL NUMBER	NSI DETONATOR SERIAL NUMBER	DETONATOR/ EXPLOSIVE LEAD GAP	EXPLOSIVE LEAD/ CDF GAP	TEST TEMP.	EVALUATION
11	3683	00065	Normal ↓	Maximum ↓	Amb. ↓	UNITS TRANSFERRED INITIATION ↓
12	8365	00242				
13	8360	00137				
14	8545	00134				
15	8334	00153				

- NOTES: (1) CDF Cores completely consumed
(2) Rotors back-out to various degree
(3) All bodies remained intact.

* CDF END TIP STAND-OFF WAS ADJUSTED EQUAL TO THE WORST CASE (MAX. STAND-OFF) RESULTING FROM DIMENSIONAL STACK-UP.

(A)

J. Pena

TECHNICIAN

N/A

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
EXPLOSIVE TRAIN CONFIGURATION TEST

REPORT NUMBER 4918-208 DATE 15 MARCH 1977
JOB NUMBER 4918-78 W.O. NUMBER 208
TMC/S PART NAME EXPLOSIVE TRAIN CONFIGURATION TMC/S DWG. NUMBER 816780
CUSTOMER SPECIFICATION 10A00465 REV. A TMC/S PROCEDURE DTP 816780 REV. N/C
TEST EQUIPMENT ITEM NUMBERS 1
REQUIREMENTS UNITS SHALL TRANSFER INITIATION AND REMAIN INTACT.

CUSTOMER PART NUMBER N/A

GROUP NUMBER 4 - EXPLOSIVE LEAD UNDERLOAD

(A)

IN LINE LEAD POSITION						
UNIT NUMBER	CDF SERIAL NUMBER	NSI DETONATOR SERIAL NUMBER	DETONATOR/ EXPLOSIVE LEAD GAP	EXPLOSIVE LEAD/ CDF GAP	TEST TEMP.	EVALUATION
16	8686	00060	Normal	Maximum*	Amb.	UNITS TRANSFERRED INITIATION
17	8364	00111	↓	↓	↓	
18	8684	00094				
19	8360	00155				
20	8687	00244				

- NOTES: (1) CDF CORES COMPLETELY CONSUMED
(2) ROTORS BACK-OUT TO VARIOUS DEGREE
(3) ALL BODIES REMAINED INTACT.

* CDF END TIP STAND-OFF WAS ADJUSTED TO BE EQUAL TO THE WORST CASE (MAX. STAND-OFF) RESULTING FROM DIMENSIONAL STACK-UP.

(A)

J. Pena
TECHNICIAN

N/A
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
EXPLOSIVE TRAIN CONFIGURATION TEST

REPORT NUMBER 4918-208

DATE 15 MARCH 1977

JOB NUMBER 4918-78

W. O. NUMBER 208

TMc/S PART NAME EXPLOSIVE TRAIN CONFIGURATION

TMc/S DWG. NUMBER 816780

CUSTOMER SPECIFICATION 10A00465 REV. A

TMc/S PROCEDURE DTP 816780 REV. N/C

TEST EQUIPMENT ITEM NUMBERS 1

REQUIREMENTS UNITS SHALL TRANSFER INITIATION AND REMAIN INTACT.

CUSTOMER PART NUMBER N/A

GROUP NUMBER 5 - EXPLOSIVE LEAD OVERLOAD

(A)

UNIT NUMBER	CDF SERIAL NUMBER	NSI DETONATOR SERIAL NUMBER	DETONATOR/ EXPLOSIVE LEAD GAP	EXPLOSIVE LEAD/ CDF GAP	TEST TEMP.	IN LINE LEAD POSITION	
						EVALUATION	
21	8550	00053	Normal ↓	Normal ↓	Amb. ↓	UNITS TRANSFERRED INITIATION ↓	
22	8686	00116					
23	8359	00121					
24	8342	00098					
25	8546	00283					

- NOTES: (1) CDF CORES COMPLETELY CONSUMED
(2) ROTORS BACK-OUT TO VARIOUS DEGREE
(3) ALL BODIES REMAINED INTACT.

J. Pena

TECHNICIAN

N/A

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S _____



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
EXPLOSIVE TRAIN CONFIGURATION TEST

REPORT NUMBER 4918-208 DATE 16 MARCH 1977
JOB NUMBER 4918-78 W.O. NUMBER 208
TMC/S PART NAME EXPLOSIVE TRAIN CONFIGURATION TMC/S DWG. NUMBER 816780
CUSTOMER SPECIFICATION 10A00465 REV. A TMC/S PROCEDURE DTP 816780 REV. N/C
TEST EQUIPMENT ITEM NUMBERS 1
REQUIREMENTS DETERMINE MAXIMUM ANGULAR MISALIGNMENT OF EXPLOSIVE TRANSFER CHARGE
FOR RELIABLE PROPAGATION OF EXPLOSIVE TRAIN.
CUSTOMER PART NUMBER N/A
GROUP NUMBER 6 - ANGULAR MISALIGNMENT

(A)

UNIT NUMBER	CDF SERIAL NUMBER	NSI DETONATOR SERIAL NUMBER	DETONATOR/ EXPLOSIVE LEAD GAP	EXPLOSIVE LEAD/ CDF GAP	TEST TEMP.	ROTOR ANGLE	FIRE	NO-FIRE
26	8670	00279	Normal ↓	Normal ↓	Amb. ↓	37.0°	X	
27	8361	00125				36.0°	X	
28	8364	00249				40.5°		0
29	8536	00239				38.0°		0
30	8538	00245				32.5°	X	
31	8542	00135				35.0°		0
32	8670	00118				33.5°	X	
33	8688	00101				34.0°	X	
34	8342	00124				37.0°		0
35	8689	00133				35.5°	X	
36	8361	00250	↓	↓	↓	36.0°		0
37	8684	00130				36.0°		0
38	8355	00136				34.5°		0
39	8536	00129				30.5°	X	
40	8683	00063				32.5°	X	

TEST METHOD: LANGLEIE RELIABILITY TEST METHOD FOR "ONE SHOT ITEMS"

J. Pena

TECHNICIAN

N/A

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
EXPLOSIVE TRAIN CONFIGURATION TEST

REPORT NUMBER 4918-208 DATE 16 MARCH 1977
JOB NUMBER 4918-78 W.O. NUMBER 208
TMC/S PART NAME EXPLOSIVE TRAIN CONFIGURATION TMC/S DWG. NUMBER 816780
CUSTOMER SPECIFICATION 10A00465 REV. A TMC/S PROCEDURE DTP 816780 REV. N/C
TEST EQUIPMENT ITEM NUMBERS 1
REQUIREMENTS DETERMINE MAXIMUM ANGULAR MISALIGNMENT OF EXPLOSIVE TRANSFER CHARGE
FOR RELIABLE PROPAGATION OF EXPLOSIVE TRAIN.
CUSTOMER PART NUMBER N/A
GROUP NUMBER 6 (CONT.)

UNIT NUMBER	CDF SERIAL NUMBER	NSI DETONATOR SERIAL NUMBER	DETONATOR/ EXPLOSIVE LEAD GAP	EXPLOSIVE LEAD/ CDF GAP	TEST TEMP.	ROTOR ANGLE	FIRE	NO-FIRE
41	8688	00281	Normal	Normal	Amb.	34.5°	X	
42	8542	00093	↓	↓	↓	35.5°	X	
43	8365	00105				40.0°		0
44	8334	00106				37.5°		0
45	8689	00098	↓	↓	↓	36.0°	X	1

1 EXPLOSIVE CORE COMPLETELY CONSUMED
LEAD SHEATH REMAINED INTACT.

TEST METHOD: LANGLIE RELIABILITY TEST METHOD FOR "ONE SHOT ITEMS".

J. Pena

TECHNICIAN

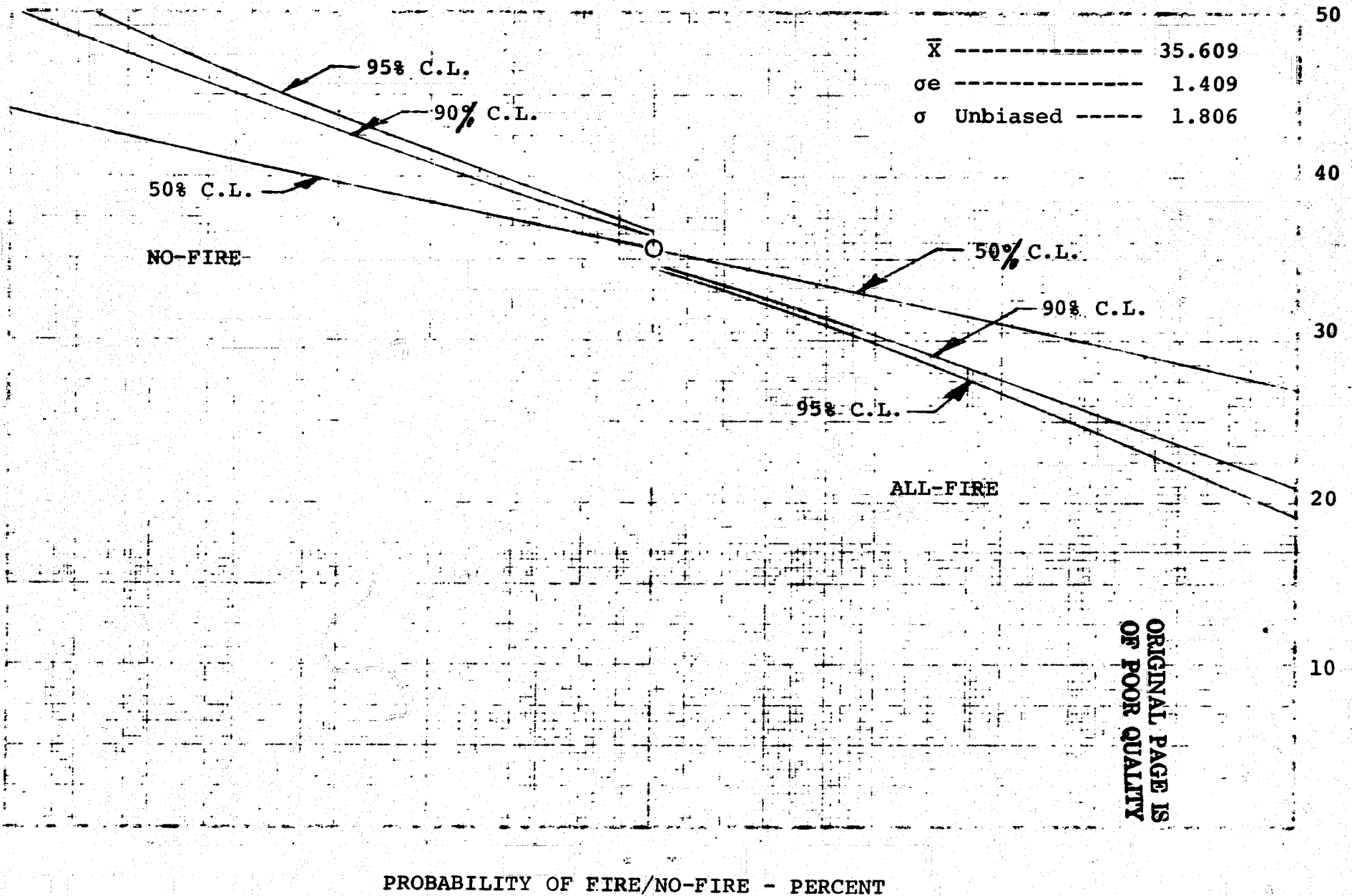
N/A

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S

SENSITIVITY TEST
FOR
EXPLOSIVE TRAIN PROPAGATION



APPENDIX C

TEST REPORT 4918-213
FULL SCALE SAFE AND ARM TESTS

DEVELOPMENT	TEST REPORT	JOB NO. 4918-78-213
TMcS DRAWING NO. 816780 REV. B		REPORT NO. 4918-213
CUST. DRAWING NO. 10A00465		LOT NO. 4918-2
ITEM SAFETY & ARMING DEVICE (S&A)		

	TEST PERFORMED BY TELEDYNE McCORMICK SELPH HOLLISTER, CALIFORNIA
	TEST AUTHORIZED BY NASA/MSFC P. O. NO.: NAS8-31973

	DATE	SIGNATURE
TEST ENGINEER	7/14/77	<i>Harry Lowe</i>
PROJECT ENGINEER	7/14/77	<i>Frank Mortels</i>
RELIABILITY	7/18/77	<i>Dennis Keeper</i>
FINAL RELEASE TEST DATA SECTION	7/18/77	<i>Betty Lowe</i>

 TELEDYNE McCORMICK SELPH

JOB NUMBER 4918-78 **W.O.** 213

REPORT NUMBER 4918-213

DATE 13 JULY 1977

PURPOSE OF TEST

LOT ACCEPTANCE ☐

DEVELOPMENT ☒

PREPROD/PERIODIC/QUAL ☐

ENG. EVALUATION ☐

PRELOAD ☐

FAILURE ANALYSIS ☐

PERFORMANCE INSTRUCTIONS

TEST FOUR (4) EACH FULL-SCALE SAFE AND ARM PER TABLE II OF DTP 816780
REV. A.



TELEDYNE McCORMICK SELPH

Hollister, Calif. • 95023

TEST REPORT

JOB NUMBER 4918-76 WO. 213

REPORT NUMBER 4918-213

DATE 13 JULY 1977

EQUIPMENT LIST

ITEM NO.	NAME	MANUFACTURER	MODEL	ACCURACY	CALIBRATION DUE DATE
1	MEGOHMMETER	FREED	1620	$\pm 5\%$ FS	7/7/77
2	STOP WATCH	MEYLAN	202A	$\pm 1\%$ FS	8/14/77
3	VACUUM PUMP	CENCO	MECAVAC	N/A	N/A
4	VACUUM GAUGE	MATHESON	63-4101	$\pm 0.5"$ Hg	9/28/77
5	VACUUM CHAMBER	TMc/S	N/A	N/A	N/A
6	POWER SUPPLY	TMc/S	0-32 VOLTS	$\pm 5\%$	N/A
7	TIME MARK GENERATOR	TMc/S	10 MS	$\pm .001\%$	7/28/77
8	OSCILLOGRAPH	HONEYWELL	906	N/A	N/A
9	FUNCTION MONITOR	DAUGHLESS	SA1077-1	$\pm 1\%$	7/28/77
10	POWER SUPPLY	LAMBDA	LE103FM-0317	USE WITH CALIB. INST.	
11	TORQUE WRENCH	STURTEVANT	F-200-1	$\pm 3\%$ RDG.	8/7/77
12	TIME MARK GENERATOR	TMc/S	J. MAR	.001% FS	12/21/77
13	CONTROL PANEL BOX	TMc/S	SA 1077-1	$\pm 2\%$	7/28/77
14	TEMPERATURE CHAMBER	MISSIMERS	T5	USE WITH CALIB. INST.	
15	TEMPERATURE RECORDER	HONEYWELL	31F1	$\pm 1\%$	USE WITH CALIB. INST.

SERIAL NUMBER CORRESPONDANCE

IN PROCESS UNIT NUMBER	ASSIGNED SERIAL NUMBER
30	0001
31	0002
32	0003
33	0004



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
LEAKAGE TEST

REPORT NUMBER 4918-213 DATE SEE BELOW
JOB NUMBER 4918-78 W.O. NUMBER 213
TMC/S PART NAME SAFE & ARMING DEVICE (S & A) TMC/S DWG. NUMBER 816780 REV. B
CUSTOMER SPECIFICATION NASA 10A00465 TMC/S PROCEDURE DTP 816780 REV. A
TEST EQUIPMENT ITEM NUMBERS 2, 3, 4, & 5
REQUIREMENTS NO EVIDENCE OF LEAKAGE (INDICATED BY A CONTINUOUS RELEASE OF A STREAM OF,
OR A GROWTH OF BUBBLES).

CUSTOMER PART NUMBER N/A

UNIT NUMBER	SERIAL NUMBER	DATE TESTED	IN. Hg.	RESULTS
1	30	5/19/77	<2.04	Leak at roll pin
2	31	5/19/77	<2.04	Leak at roll pin
3	32	5/19/77	<2.04	Leak at roll pin
4	33	5/19/77	<2.04	Leak at roll pin
1	30	5/24/77	<2.04	No visible leakage
2	31	5/24/77	<2.04	No visible leakage
3	32	5/24/77	<2.04	No visible leakage
4	33	5/24/77	<2.04	Leak on seal near pin
1	30	6/6/77	<2.04	No visible leakage
2	31	6/6/77	<2.04	No visible leakage
3	32	6/6/77	<2.04	No visible leakage
4	33	6/6/77	<2.04	No visible leakage

H. Koue

TECHNICIAN

N/A

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S _____

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-213

DATE 19 MAY 1977

JOB NUMBER 4918-76

W. O. NUMBER 213

TMC/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. B

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S PROCEDURE DTP 816780 REV. A

TEST EQUIPMENT ITEM NUMBERS 6, 7, 8, & 9

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 3

SERIAL NO. 32

TEST TEMP. AMB.

32 VOLTS DC				28 VOLTS DC				24 VOLTS DC			
AMPS	TIME (SEC.)	SAFE	ARM	AMPS	TIME (SEC.)	SAFE	ARM	AMPS	TIME (SEC.)	SAFE	ARM
< 3	<.250		X	<3	<.250		X	<3	<.250		X
< 3	<.250	X		<3	<.250	X		<3	<.250	X	
< 3	>.250 ⚠	X		<3	<.250	X		<3	<.250	X	
< 3	<.250	X		<3	<.250	X		<3	<.250	X	
< 3	<.250	X		<3	<.250	X		<3	<.250	X	
< 3	<.250	X		<3	<.250	X		<3	<.250	X	
< 3	<.250	X		<3	<.250	X		<3	<.250	X	
< 3	<.250	X		<3	<.250	X		<3	<.250	X	
< 3	<.250	X		<3	<.250	X		<3	<.250	X	

⚠ The unit did not arm within .250 seconds.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

K. Hane
TECHNICIAN

N/A

WITNESS

- VALUATION OF TEST RESULTS (CHECK ONE)

11 ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
3 DISCREPANCY/S NOTED OF UNIT

See TMc/S Discrepancy Report # 34147

located on page of this report.



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
CIRCUITRY CHECKS

REPORT NUMBER 4918-213

DATE 20 MAY 1977

JOB NUMBER 4918-76

W.O. NUMBER 213

TMC/S PART NAME SAFETY & ARMING DEVICE

TMC/S DWG. NUMBER 816780 REV. B

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE DTP 816780 REV. A

REQUIREMENTS: SAFE POSITION

ARMED POSITION

A) G-H, K-N, P-R & S-T PIN TO PIN VOLTAGE
SHALL BE LESS THAN 750 MILLIVOLTS @
2.5 AMPERES

A) J-H, K-L, R-N, & T-U PIN TO PIN VOLTAGE
SHALL BE LESS THAN 750 MILLIVOLTS @ 2.5
AMPERES.

B) J-H, K-L, R-N & T-U PIN TO PIN SHOULD
INDICATE AN OPEN CIRCUIT.

B) G-H, K-N, P-R & S-T PIN TO PIN SHOULD
INDICATE AN OPEN CIRCUIT.

UNIT S/N	①	RECORD VOLTAGE READING OR WRITE OPEN IN EACH COLUMN BELOW (MILLIVOLTS)										OHMS
		G-H	K-N	P-R	S-T	J-H	K-L	R-N	T-U	F-M	V-CASE	
30	S	<750	<750	<750	<750	OPEN	OPEN	OPEN	OPEN	<750	<750	N/A
	A	OPEN	OPEN	OPEN	OPEN	<750	<750	<750	<750	N/A	N/A	
31	S	<750	<750	<750	<750	OPEN	OPEN	OPEN	OPEN	<750	<750	N/A
	A	OPEN	OPEN	OPEN	OPEN	<750	<750	<750	<750	N/A	N/A	
32	S	<750	<750	<750	<750	OPEN	OPEN	OPEN	OPEN	<750	<750	N/A
	A	OPEN	OPEN	OPEN	OPEN	<750	<750	<750	<750	N/A	N/A	
33	S	<750	<750	<750	<750	OPEN	OPEN	OPEN	OPEN	<750	<750	N/A
	A	OPEN	OPEN	OPEN	OPEN	<750	<750	<750	<750	N/A	N/A	
	S											
	A											
	S											
	A											
	S											
	A											
	S											
	A											

① UNIT POSITION S = SAFE A = ARM

K. Hane
TECHNICIAN

N/A

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR

AMBIENT TEMPERATURE ELECTRICAL CHECKOUT

REPORT NUMBER 4918-213 DATE 20 MAY 1977
JOB NUMBER 4918-76 W.O. NUMBER 213
TMC/S PART NAME SAFE & ARMING DEVICE TMC/S DWG. NUMBER 816780 REV. B
CUSTOMER SPECIFICATION NASA 10A00465 TMC/S PROCEDURE DTP 816780 REV. A
TEST EQUIPMENT ITEM NUMBERS 1 & 9
REQUIREMENTS PER PARAGRAPH 8.1.5 OF DTP 816780 REV. A.

CUSTOMER PART NUMBER N/A

UNIT S/N	RECORD OPEN CIRCUIT BY (X) SYMBOL CIRCUIT V TO FOLLOWING CIRCUIT CONNECTIONS:																	
	A	R	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U
30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
31	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
32	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
33	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

K. Hane
TECHNICIAN

N/A
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S _____



TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

DATE 7 JUNE 1977

W. O. NUMBER 213

TMC/S	PART NAME	SAFETY & ARMING DEVICE
1	SAFETY	SAFETY
2	ARMING	ARMING
3	DEVICE	DEVICE

TMc/S DWG. NUMBER 816780 REV. B

CUSTOMER SPECIFICATION **NASA 10A00465**

TMc/S PROCEDURE DTP 816780 REV. A

TEST EQUIPMENT ITEM NUMBERS 6, 7, 8, & 9

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

(TESTED AFTER DISASSEMBLY AND REWORK)

UNIT NO. 3

SERIAL NO. 32

TEST TEMP. Ambient

F. Mortela
TECHNICIAN

N/A

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
 C DISCREPANCY/S NOTED OF UNIT/S

UNITS SUBJECTED TO VIBRATION AND SHOCK TESTING
AT APPROVED ENGINEERING TEST LABORATORIES.
SEE ATTACHMENT I FOR APPROVED ENGINEERING TEST
LABORATORIES REPORT NUMBER 773-2209.



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR

LEAKAGE - POST SHOCK & VIBRATION

REPORT NUMBER 4918-213

DATE 29 JUNE 1977

JOB NUMBER 4918-78

W.O. NUMBER 213

TMC/S PART NAME SAFE AND ARMING DEVICE (S & A) TMC/S DWG. NUMBER 816780 REV. B

CUSTOMER SPECIFICATION NASA 10A00465 TMC/S PROCEDURE DTP 816780 REV. A

TEST EQUIPMENT ITEM NUMBERS 2, 3, 4, & 5

REQUIREMENTS NO EVIDENCE OF LEAKAGE (INDICATED BY A CONTINUOUS RELEASE OF A
STREAM OF, OR A GROWTH OF BUBBLES).

CUSTOMER PART NUMBER N/A

UNIT NUMBER	SERIAL NUMBER	RESULTS
1	0001	No visible leakage
2	0002	Leak thru Roll Pin
3	0003	Leak thru Roll Pin
4	0004	No visible leakage

K. Hane

TECHNICIAN

N/A

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

☐ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

☒ DISCREPANCY/S NOTED OF UNIT/S S/N 0002 and S/N0003 - See DR #34147 on page
18 of this lab report and discussion in 5.3 of narrative.



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
FUNCTION

REPORT NUMBER 4918-213 DATE 29 JUNE 1977
JOB NUMBER 4918-78 W.O. NUMBER 213
TMC/S PART NAME SAFE & ARMING DEVICE (S & A) TMC/S DWG. NUMBER 816780 REV. B
CUSTOMER SPECIFICATION NASA 10A00465 TMC/S PROCEDURE DTP 816780 REV. A
TEST EQUIPMENT ITEM NUMBERS 8, 10, 11, 12, 13, 14, & 15
REQUIREMENTS THE ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250
MILLISECONDS AND THE SWITCHES PROPERLY INDICATE ROTOR POSITION. THE CDF LINE SHALL NOT
HAVE INITIATED. THERE SHALL BE NO FRAGMENTATION OF THE S&A BODY OR ROTOR.
CUSTOMER PART NUMBER N/A

UNIT NO.	S/N	GROUP NO.	TEMP. COND. (°F)	CDF LINE		DETONATOR		ROTATION TIME (MS)	ROTOR POS.	CDF LINE PROPAGATE
				SERIAL NUMBER	SERIAL NUMBER	SERIAL NUMBER	SERIAL NUMBER			
1	0001	1	+20	145	012	00127	00150	35	ARM	Yes
2	0002	1	+165	097	012	00154	00061	42	SAFE	No
3	0003	2	+165	013	013	00097	00108	39	SAFE	No
4	0004	2	+20	097	145	00119	00140	35	ARM	Yes

- NOTE: (1) ROTOR PULLED DOWN INTO UNITS APPROXIMATELY 1/2 INCH. PLASTIC VIEWING WINDOW EXPELLED.
- (2) DETONATOR BLEW OFF OF UNIT S/N 0004.

J. Pena

TECHNICIAN

N/A

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S _____

A TELEDYNE COMPANY

DISCREPANCY REPORT

ORIGINAL PAGE IS No. 34147
OF POOR QUALITYVENDOR OR WORK AREA TestDWG. NO. 8167 80 REV. BDATE 6-29-77 P.O. NO. 213JOB NO. 4918REFER TO UTP 16190
PARA. 5.4.6ITEM SAFE & Arming DeviceLOT SIZE 4 @SAMPLE SIZE —

DESCRIPTION OF DEFECTS

INSPECTION TIME

SAMPLE

100 %

ITEM

DWG. & /OR SPEC.

ACTUAL

A Q L

QTY.

100 %

1

The unit is acceptable
if there is NO EVIDENCE
of leakage (Indicated
by a continuous
release of a stream
of, or a growth of
bubbles).

Leakage From the roll
Pins
S/n 0002, & 0003

100%

—

2

PLANNER

PURCHASING

INSPECTOR L. Peña☐ M.R.B.

DISPOSITION

☒ P.R.B.

ITEM

REWORK AND USE AS IS

UAI

RTV

SCRAP

1

CONTINUE WITH BALANCE OF
TESTS. IDENTIFY LEAK AREA
ON THE DEVICE.

Units tested successfully

QUALITY ASSURANCE

ENGINEER

CUSTOMER

GOVERNMENT

CORRECTIVE ACTION TAKEN TO PREVENT RECURRENCE OF THE ABOVE DISCREPANCIES (TO BE COMPLETED BY THE
VENDOR OR PRODUCTION SUPERVISOR).

C/A Required - for C/A see section 5.0 of the
Development test report

EFFECTIVITY (DATE OR SERIAL NO.)

SEE OTHER SIDE IF REQUIRED

SIGNATURE

TITLE

ATTACHMENT I



AETL

**ORIGINAL PAGE IS
OF POOR QUALITY**

APPROVED ENGINEERING TEST LABORATORIES / 1536 EAST VALENCIA / FULLERTON, CALIFORNIA 92631 / TEL. (714) 879-6110
A NATIONAL TECHNICAL SERVICES COMPANY

Test Report No. 773-2209

**REPORT OF
DEVELOPMENT VIBRATION
AND SHOCK TESTS**

**PERFORMED ON
SAFETY AND ARMING DEVICE (S & A)
P/N 816780**

**PERFORMED FOR
TELEDYNE MCCORMICK-SELPH
3601 UNION ROAD
HOLLISTER, CALIFORNIA 95023**

**PERFORMED BY
APPROVED ENGINEERING TEST LABORATORIES
1536 EAST VALENCIA DRIVE
FULLERTON, CALIFORNIA 92631**

JUNE 1977

OTHER DIVISIONS

LOS ANGELES DIVISION / 5320 WEST 104TH STREET / LOS ANGELES, CALIFORNIA 90045 / (213) 776-3202
VALLEY DIVISION / 9551 CANOGA AVENUE / CHATSWORTH, CALIFORNIA 91311 / (213) 341-0830
SAUGUS DIVISION / 20988 W. GOLDEN TRIANGLE RD. / SAUGUS, CALIFORNIA 91350 / (805) 259-8184
CALIFORNIA TEST LABS DIV. / 1432 POTRERO AVE. / SO. EL MONTE, CA 91733 / (213) 283-8465
SO. EL MONTE DIV. / 1431 POTRERO AVENUE / SO. EL MONTE, CALIFORNIA 91733 / (213) 444-9511

NOTICES

When government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.



APPROVED ENGINEERING TEST LABORATORIES

ADMINISTRATIVE DATA

DATE: 21 June 1977

1. PURPOSE OF TEST: To perform Development Vibration and Shock Tests in accordance with the specifications cited below.
2. MANUFACTURER: Teledyne McCormick-Selph (TMC/S)
3. MANUFACTURER'S PART NO.: 816780
4. DESCRIPTION OF TEST ITEM: Safety and Arming Device (S & A)
5. REFERENCES:
 1. TMC/S Development Test Procedure No. DTP 816780
 2. MIL-STD-810B(4)
6. QUANTITY OF ITEMS TESTED: Four, S/N's 0001, 0002, 0003, and 0004.
7. SECURITY CLASSIFICATION: Unclassified
8. DATE TESTS COMPLETED: 14 June 1977
9. TESTS CONDUCTED BY: Approved Engineering Test Laboratories, Fullerton Division
10. DISPOSITION OF TEST ITEMS: Returned to: Teledyne McCormick-Selph
3601 Union Road
Hollister, CA 95023
11. PURCHASE ORDER NUMBER: 93929RR
12. GOVERNMENT CONTRACT NO.: NAS8-31973



APPROVED ENGINEERING TEST LABORATORIES

ADMINISTRATIVE DATA

13. ABSTRACT:

Test No.	Page No.	Test	DTP 816780	Results
			Para.	
1	5	Sinusoidal Vibration	8.2	*
2	8	Random Vibration	8.3	*
3	33	Ordnance Shock	8.4	*
4	45	SRB Water Landing Shock and SRB Parachute Deployment Shock	8.4 8.4	* *

*The dynamic environments were furnished by AETL and all functional monitoring and Performance Tests were performed by a McCormick Selph representative. There was no visible evidence of physical damage resulting from the tests.

- 63 APPENDIX 1 - Description of Test Apparatus
66 APPENDIX 2 - Photographs

14. STANDARDS TEST CONDITIONS: Room Ambient.

15. SOURCE INSPECTION: Teledyne McCormick-Selph and AETL QA.



FACTUAL DATA

1.0 SINUSOIDAL VIBRATION TEST

1.1 REFERENCES AND REQUIREMENTS

TMc/S DTP 816780A, paragraph 8.2

1.2 ITEMS TESTED - S & A's S/N's 0001 and 0002

1.3 TEST PROCEDURE

1.3.1 Installation

The test items were mounted on flat plate test fixtures mounted on a cube-type intermediate fixture attached to the vibration machine, as illustrated in Photograph No. 1. The specified torque valve was employed to mount the items.

1.3.2 Test Conditions (TMc/S Functions)

The test items were set in the ARMED position and the switch position was monitored for rotation of more than 7.5° during the vibration. Following each axis of vibration the unit was rotated from ARM to SAFE to ARM and the elapsed time of the rotation was measured.

1.3.3 Vibration

The test items were subjected to one frequency scan from 3 to 50 Hz at a sweep rate of 3 octaves/minutes in 7.5 minutes in each of the three orthogonal axes at the following levels:

<u>Frequency (Hz)</u>	<u>Level</u>
3.0 to 8.5	0.80 inch da
8.5 to 35.0	±3 g
35.0 to 50.0	±1 g



APPROVED ENGINEERING TEST LABORATORIES

FACTUAL DATA

1.4 RESULTS

There was no reported malfunction during or following the vibration, and no visible evidence of physical damage resulting from the test.

1.5 DESCRIPTION OF TEST APPARATUS

See Appendix 1.

1.6 PHOTOGRAPH

See Appendix 2, Photograph No. 1

1.7 TEST DATA

One exposure data sheet is included. Functional data were retained by TMC/S.



FACTUAL DATA

2.0 RANDOM VIBRATION TEST

2.1 REFERENCES AND REQUIREMENTS

TMc/S DTP 816780A, paragraph 8.3

2.2 ITEMS TESTED - S & A's S/N's 0001 and 0002

2.3 TEST PROCEDURE

2.3.1 Installation

The test items were mounted on flat plate test fixtures mounted on a cube-type intermediate fixture attached to the vibration machine, as illustrated in Photograph No. 1. The specified torque valve was employed to mount the items. The items were tested together in the X and Z axes as shown, but were tested individually in the Y axis on the top of the cube.

2.3.2 Test Conditions (TMc/S Functions)

The test items were set in the ARMED position for Lift-off and Boost Vibration and in the SAFE position for Re-entry Vibration. During the vibration the switch position was monitored for rotation in excess of 7.5°. Following the vibration in each axis, the S & A was cycled from SAFE to ARMED to SAFE and the elapsed time of each 90° rotation was measured.

2.3.3 Vibration Sequence

The Lift-off Vibration was conducted first in the three test axes in Y, X, and Z order followed by the Boost Vibration in the same order and Re-entry Vibration in same order.



APPROVED ENGINEERING TEST LABORATORIES

FACTUAL DATA

2.3.4 Test Levels and Test Times

Vibration was conducted in accordance with the following tables:

Lift-Off Vibration (ARMED)

<u>Y - Axis</u>			<u>X & Z Axes</u>		
<u>Freq. (Hz)</u>		<u>PSD</u>	<u>Freq. (Hz)</u>		<u>PSD</u>
20 - 40		+3 db/octave increase	20 - 40		+3 db/octave increase
40 - 54		0.15 g ² /Hz	40 - 280		0.08 g ² /Hz
53 - 100		+9 db/octave increase	280 - 400		+6 db/octave increase
100 - 170		0.95 g ² /Hz	400 - 800		0.16 g ² /Hz
170 - 2000		-3 db/octave roll-off	800 - 2000		-6 db/octave roll-off
Overall		22.2 grms	Overall		13.2 grms
Test Time		60 seconds/axis	Test Time		60 seconds/axis

Boost Vibration (ARMED)

<u>Y - Axis</u>			<u>X & Z Axes</u>		
<u>Freq. (Hz)</u>		<u>PSD</u>	<u>Freq. (Hz)</u>		<u>PSD</u>
20 - 40		+3 db/octave increase	20 - 40		+3 db/octave increase
40 - 53		0.28 g ² /Hz	40 - 95		0.056 g ² /Hz
53 - 100		+6 db/octave increase	95 - 250		+3 db/octave increase
100 - 170		1.0 g ² /Hz	250 - 440		0.15 g ² /Hz
170 - 2000		-3 db/octave roll-off	440 - 500		+9 db/octave increase
Overall		22.9 grms	500 - 800		0.22 g ² /Hz
Test Time		120 seconds/axis	800 - 2000		-6 db/octave roll-off
			Overall		15.2 grms
			Test Time		120 seconds/axis



APPROVED ENGINEERING TEST LABORATORIES

FACTUAL DATA

Re-entry Vibration (SAFE)

<u>Y - Axis</u>			<u>X & Z Axes</u>		
<u>Freq. (Hz)</u>		<u>PSD</u>	<u>Freq. (Hz)</u>		<u>PSD</u>
20 - 40	Hz @ +3 db/octave increase		20 - 40	0.75 g ² /Hz	
40 - 60	Hz @ 1.00 g ² /Hz		40 - 60	-12 db/octave roll-off	
60 - 75	Hz @ -12 db/octave roll-off		60 - 400	0.13 g ² /Hz	
75 - 230	Hz @ 0.36 g ² /Hz		400 - 2000	-3 db/octave roll-off	
230 - 500	Hz @ -12 db/octave roll-off		Overall	12.2 grms	
500 - 1000	Hz @ 0.017 g ² /Hz		Test Time	90 seconds/axis	
1000 - 2000	Hz @ -6 db/octave roll-off				
Overall	11.9 grms				
Test Time	90 seconds/axis				

2.3.5 Test Tolerances

Power spectral density tolerances were ± 1.5 db from 20 to 500 Hz and ± 3 , 1.5 db from 500 to 2000 Hz. The grms tolerance was ± 10 percent.

2.3.6 Equalization

Prior to each type of vibration in the vertical (Y) axis and in the lateral axes, the vibration system including the test fixture configuration was equalized at the test level.

2.3.7 Analysis and Data Recording

The vibration spectrum in each equalization and test run was analyzed with a real time analyzer and recorded on an X-Y recorder, frequency versus power spectral density.

2.4 RESULTS

There was no reported malfunction during or following the vibration, and no visible evidence of physical damage resulting from the test.



APPROVED ENGINEERING TEST LABORATORIES

FACTUAL DATA

2.5 DESCRIPTION OF TEST APPARATUS

See Appendix 1.

2.6 PHOTOGRAPH

See Appendix 2, Photograph No. 1

2.7 TEST DATA

Two exposure data sheets and 18 X-Y recordings are attached. Functional data were retained by TMC/S.



APPROVED ENGINEERING TEST LABORATORIES
A NATIONAL TECHNICAL SERVICES CO.

NTS

SHEET #1

AETL VIBRATION TEST DATA

Date Started:

6-13-77

Date Completed:

6-14-77

Customer:

TELEDYNE Mc CORMICK SELPH

Test:

Random

M.J.O.:

773-2209

Performed By:

G.W. CAYER

Test Engineer:

G. MATTESON

Witnessed By:

AETL
70
QC

Specimen Description:

SAFETY AND ARMING DEVICE

Specimen Part No.

816780 (06331-816780-3)

Specification:

D.T.P. 816780 PARA 8.2.4

Date	Time	Temperature	Frequency Bandwidth	P.S.D. Level	Roll-Up	Roll-Off	Acceleration Level	Duration	Axis	Test Sequence	Plot No.	Specimen Serial No.	Remarks
Day	Hour	°F	Hz	G ² /Hz	db/oct	db/oct	Grms	SEC.	X-Y-Z	Noted	Noted	Noted	Units
6-13-77	1323	AMB	20-40	—	3	—	22.2	N/A	Y	1	1		FIXTURE EQUALIZATION (LIFT OFF) (ARMED POSITION)
			40-54	.15	—	—							
			54-100	—	9	—							
			100-170	.95	—	—							
			170-2000	—	—	3							
Y	1559		SAME AS ABOVE				22.2	60	Y	2	2		0001 RANDOM RUN
6-13-77	1605		SAME AS ABOVE				22.2	60	Y	3	3		0002 RANDOM RUN
6-14-77	0850		20-40	—	3	—	13.2	N/A	X+Z	4	4		FIXTURE EQUALIZATION (LIFT OFF) (ARMED POSITION)
			40-280	.08	—	—							
			280-400	—	6	—							
			400-800	.16	—	—							
			800-2000	—	—	6							
0902			SAME AS ABOVE				13.2	60	X	5	5		0001 RANDOM RUN
0914			SAME AS ABOVE				13.2	60	Z	6	6		0002 RANDOM RUN
0953			20-40	—	3	—	22.9	N/A	Y	7	7		" RANDOM RUN
			40-53	.28	—	—							FIXTURE EQUALIZATION (BOOST) (ARMED POSITION)
			53-100	—	6	—							
			100-170	1.0	—	—							
			170-2000	—	—	3							
Y	0957	Y	SAME AS ABOVE				22.9	120	Y	8	8		0001 RANDOM RUN
6-14-77	1024	AMB	SAME AS ABOVE				22.9	120	Y	9	9		0002 RANDOM RUN



NTS

SHEET #2

Date Started: 6-14-77	AETL VIBRATION TEST DATA		M.J.O.: 773-2209
Date Completed: 6-14-77	Customer: TELEDYNE Mc CORMICK SELPH	Test: Random	Performed By: G.W. CAYER
Specimen Description: SAFETY AND ARMING DEVICE	Specimen Part No. 06331-816780-3	Test Engineer: G. MATTESON	Witnessed By: AETL 30 QC
Specification: D.T.P. 816780 PARA. 8.3			

Date		Time	Temperature	Frequency Bandwidth	P.S.D. Level	Roll-Up	Roll-Off	Acceleration Level	Duration	Axis	Test Sequence	Plot No.	Specimen Serial No.	Remarks
Day	Hour	°F	Hz	G ² /Hz	db/oct	db/oct	Grms	SEC	X-Y-Z	Noted	Noted	Noted	Noted	Units
6-14-77	1108	AMB	20-40	—	3	—	15.2	N/A	X+Z	10	10			FIXTURE EQUALIZATION
			40-95	.056	—	—								(BOOST) (ARMED POSITION)
			95-250	—	3	—								
			250-440	.15	—	—								
			440-580	—	9	—								
			500-800	.22	—	—								
			800-2000	—	—	6								
	1114		SAME As ABOVE				15.2	120	X	11	11		0001	RANDOM RUN
	1124		SAME As ABOVE				15.2	120	Z	12	12		0001	RANDOM RUN
	1227		20-40	—	3	—	11.9	N/A	Y	13	13		0002	RANDOM RUN
			40-60	1.0	—	—								FIXTURE EQUALIZATION
			60-75	—	—	12								(REENTRY) (SAFE POSITION)
			75-230	0.36	—	—								
			230-500	—	—	12								
			500-1000	.017	—	—								
			1000-2000	—	—	6								
Y	1238	Y	SAME As ABOVE				11.9	90	Y	14	14		0002	RANDOM RUN
6-14-77	1248	AMB	SAME As ABOVE				11.9	90	Y	15	15		0001	RANDOM RUN

ORIGINAL PAGE IS
OF POOR QUALITY

CUSTOMER TELEDYNE Mc GRAW HILL

MJO NO. 773-2209

TEST ITEM SAFE ARM DEVICE

PART NO. FIXTURE

SERIAL NO. NONE

DATE 6-13-77

INPUT LEVEL 22.2 GRMS (22.2 g_{rms})

ACCELEROMETER NO. 1

AXIS Y (ARMED POSITION)

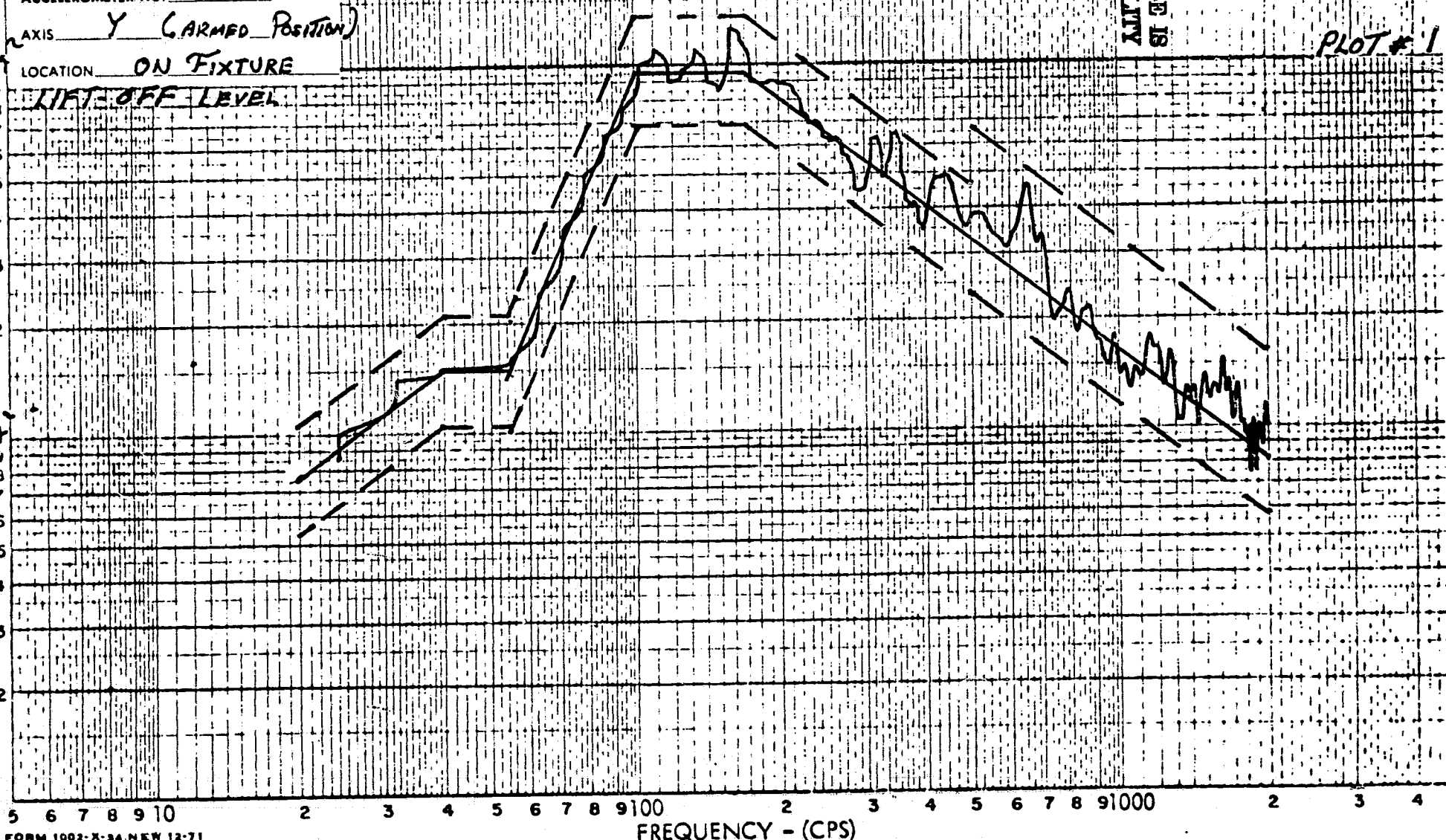
LOCATION ON FIXTURE

LIFT OFF LEVEL

ORIGINAL PAGE IS
ON POOR QUALITY

EQUALIZATION

PLOT # 1



CUSTOMER TELEDYNE Mc GRATH SERPH

MJO NO. 773-2209

TEST ITEM SAFE ARM DEVICE

PART NO. 06331-816780-3

SERIAL NO. 0001

DATE 6-13-77

INPUT LEVEL 22.2 GRMS (22.2 g_{rms})

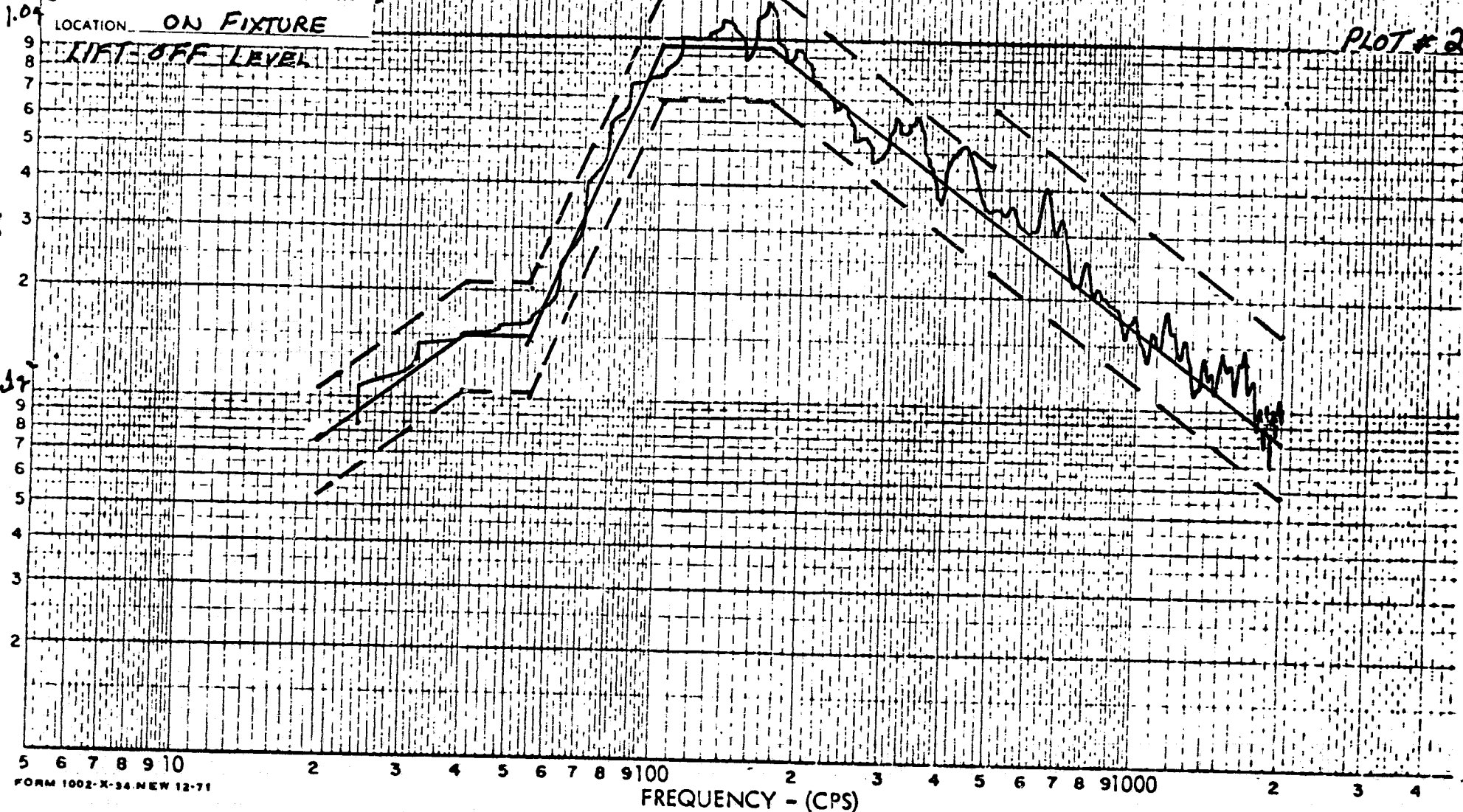
ACCELEROMETER NO. 1

AXIS Y (ARMED POSITION)

LOCATION ON FIXTURE

LIFT-OFF LEVEL

PLOT #2



104

9
8
7
6
5
4
3
2
1
- 17 -
Report No. 773-2209

CUSTOMER TELEDYNE Mc GRATH SELPH

MJO NO. 773-2209

TEST ITEM SAFE ARM DEVICE

PART NO. 06331-816780-3

SERIAL NO. 0002

DATE 6-13-77

INPUT LEVEL 22.2 GRMS (22.2 g_{rms})

ACCELEROMETER NO. 1

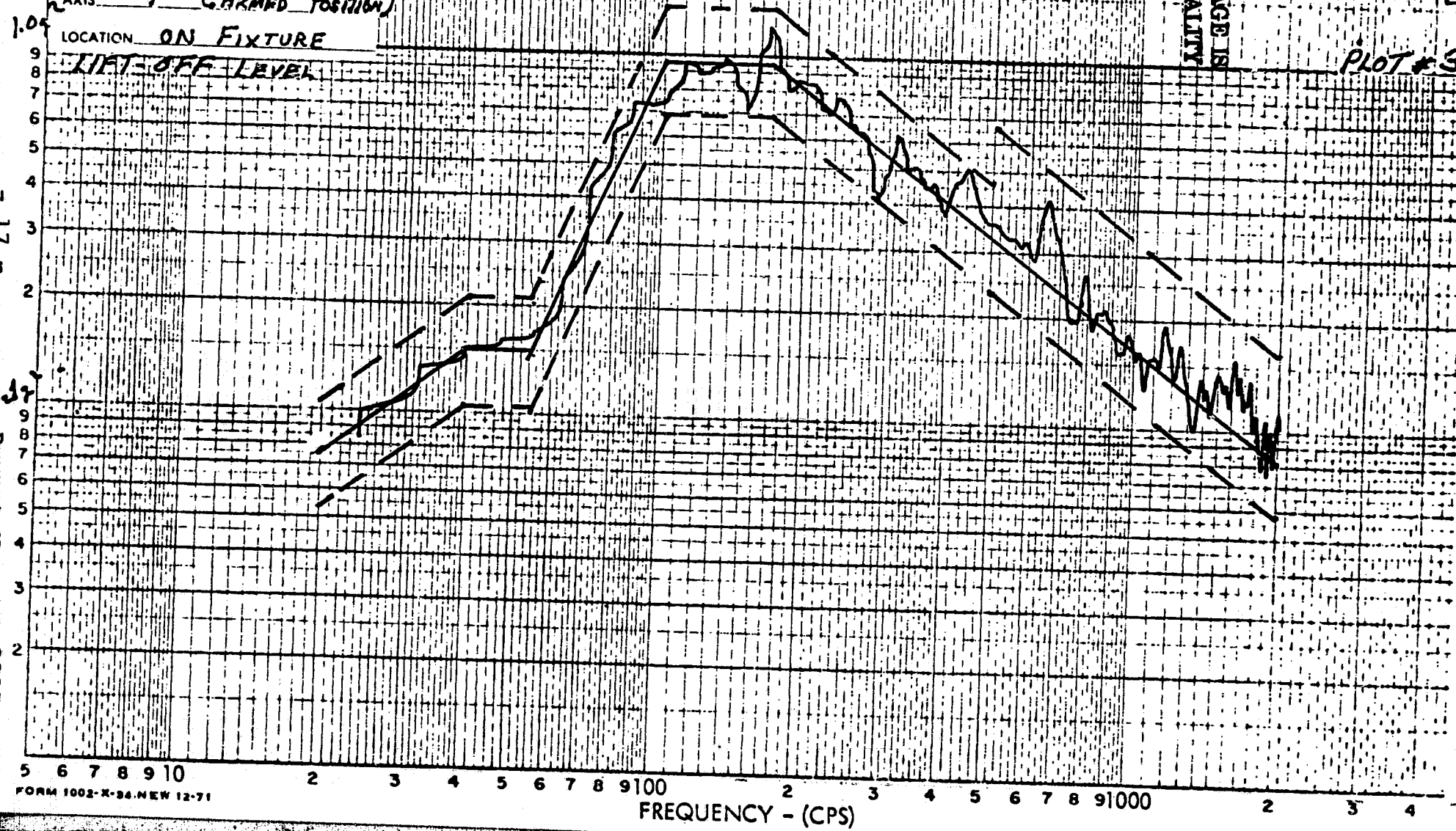
AXIS Y (ARMED POSITION)

LOCATION ON FIXTURE

LIFT-OFF LEVEL

ORIGINAL PAGE IS
OF POOR QUALITY

PLOT #3



1.0

CUSTOMER TELEDYNE Mc CORMICK SELPHMJO NO. 773-2209TEST ITEM SAFE / ARM DEVICEPART NO. FIXTURESERIAL NO. NONEDATE 6-14-77INPUT LEVEL 13.2 GRMS 13.2ACCELEROMETER NO. 1AXIS X + Z (ARMED Pos) x+zLOCATION ON FIXTURE

LIFT OFF LEVEL

EQUALIZATION

PLOT # 4

1.1

18

0.1

Report No. 773-2209

5 6 7 8 9 10

2

3

4

5

6

7

8

9

100

2

3

4

5

6

7

8

9

1000

2

3

4

FREQUENCY - (CPS)

FORM 1002-X-34 NEW 12-71

CUSTOMER TELEDYNE Mc CORMICK SELPH

MJO NO. 773-2209

TEST ITEM SAFE / ARM DEVICE

PART NO. 06331-816780-3

SERIAL NO. 0001 + 0002

DATE 6-14-77

INPUT LEVEL 13.2 GRMS 13.2

ACCELEROMETER NO. 1

AXIS X (ARMED POS) X+Z

LOCATION ON FIXTURE

LIFT OFF LEVEL

PLOT # 5

ORIGINAL PAGE IS
OF POOR QUALITY

5 6 7 8 9 10

2

3

4

5

6

7

8

9

100

2

3

4

5

6

7

8

9

1000

2

3

4

FREQUENCY - (CPS)

FORM 1002-X-94 NEW 12-71

Report No. 773-2209

CUSTOMER **TELEDYNE Mc CORMICK SELPH**

MJO NO. **773-2209**

TEST ITEM **SAFE / ARM DEVICE**

PART NO. **06331-816780-3**

SERIAL NO. **0001 + 0002**

DATE **6-14-77**

INPUT LEVEL **13.2 GRMS** 13.2

ACCELEROMETER NO. **1**

AXIS **Z** (ARMED POS) X+Z

LOCATION **ON FIXTURE**

LIFT OFF LEVEL

PLOT # 6

FREQUENCY - (CPS)

FORM 1002-X-34-NEW 12-71

Report No. 773-2209

CUSTOMER TELE DYNE M. CORNUK SELPH

MJO NO. 773-2209

TEST ITEM SAFE / ARM DEVICE

PART NO. FIXTURE

SERIAL NO. NONE

DATE 6-14-77

INPUT LEVEL 22.9 GRMS (22.9 g rms)

ACCELEROMETER NO. 1

AXIS Y (ARMED Pos.)

LOCATION ON FIXTURE

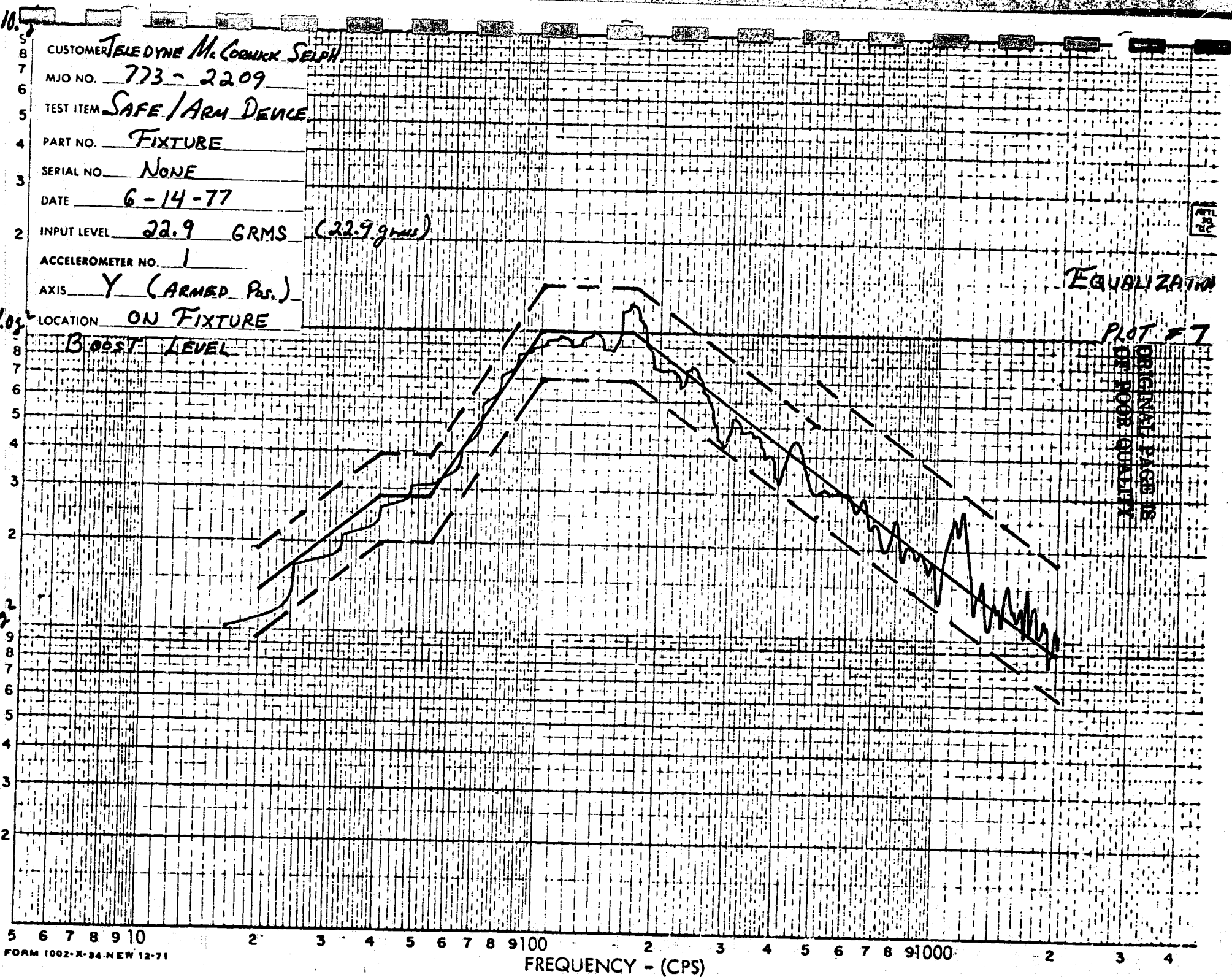
BOOST LEVEL

10.5

- 21 -

22

Report No. 773-2209



CUSTOMER TELE DYNE Mc CONNELL SELPH

MJO NO. 773-2209

TEST ITEM SAFE / ARM DEVICE

PART NO. 06331-816780-3

SERIAL NO. 0001

DATE 6-14-77

INPUT LEVEL 22.9 GRMS (22.9gms)

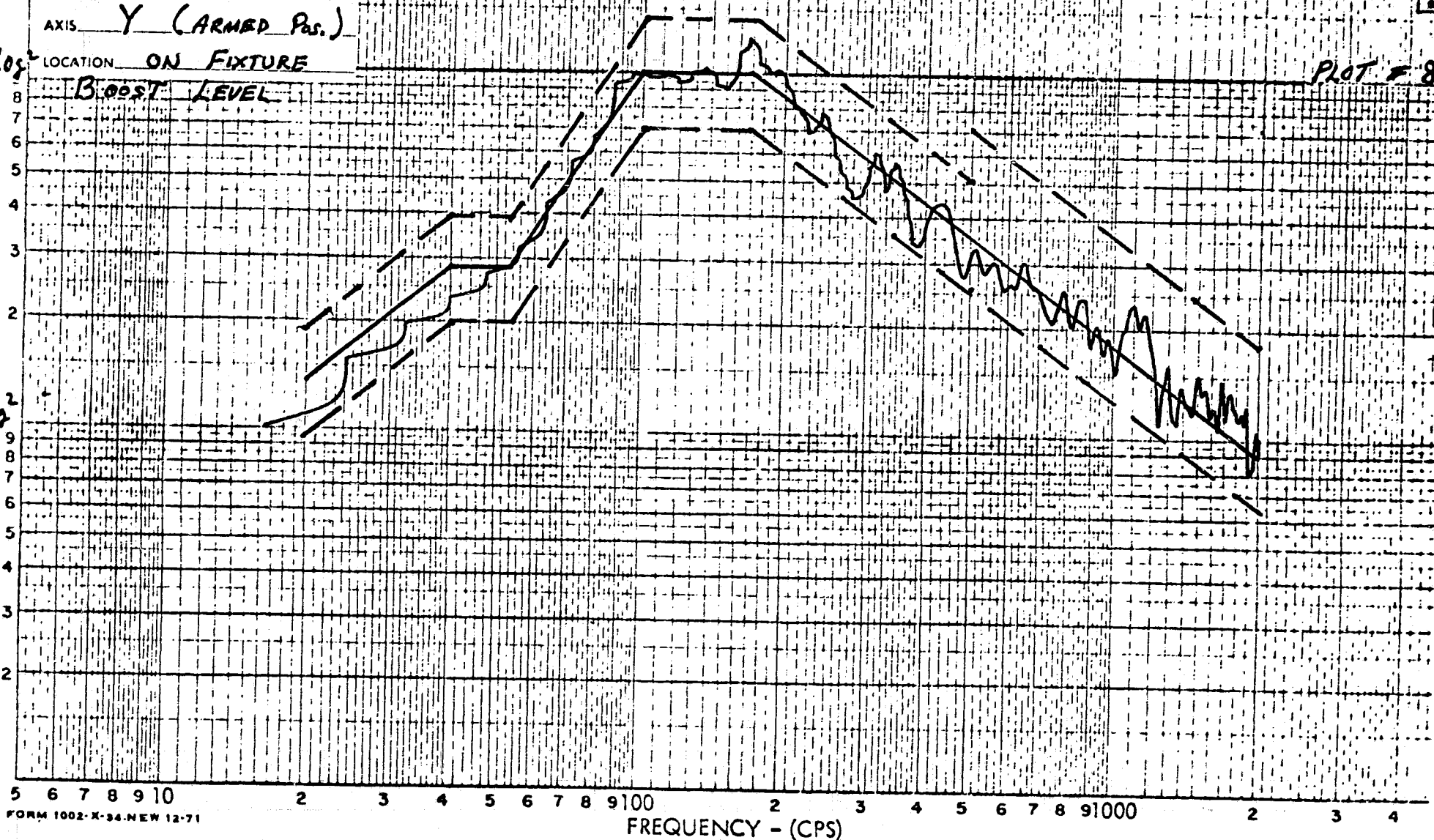
ACCELEROMETER NO. 1

AXIS Y (ARMED Pos.)

LOCATION ON FIXTURE

BOOST LEVEL

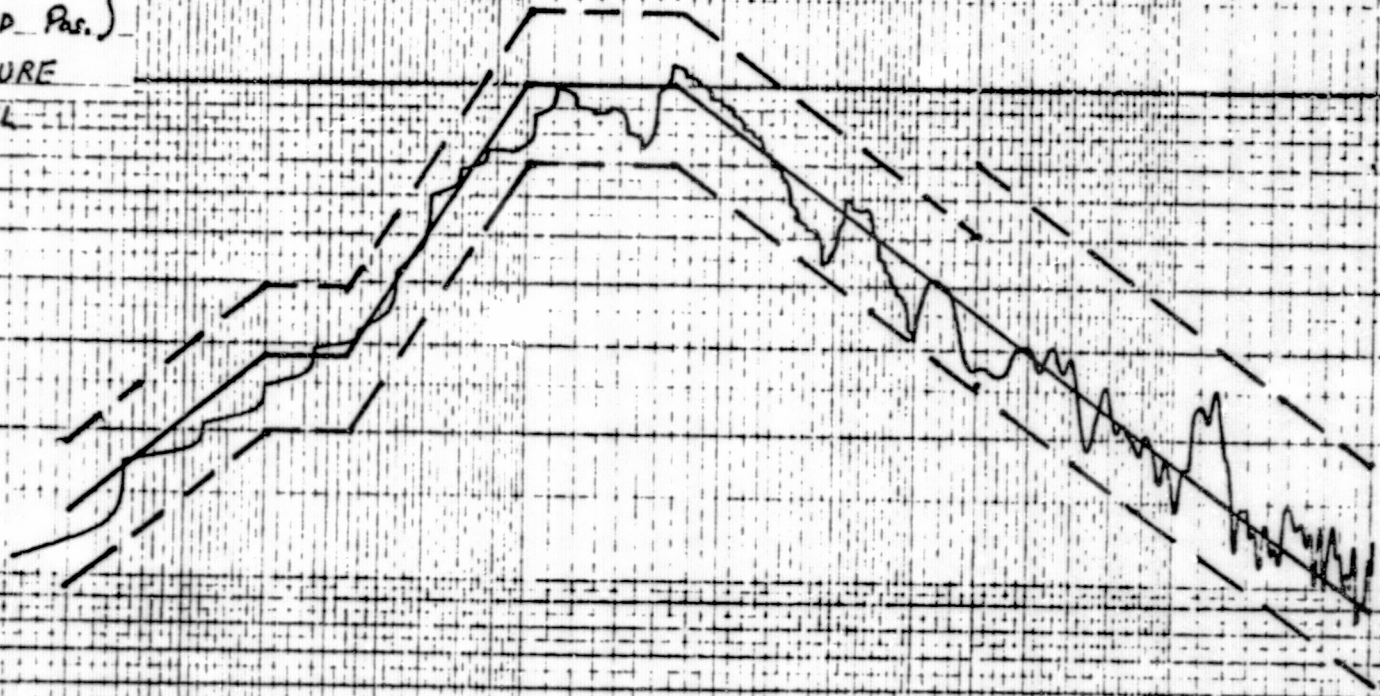
PLOT # 8



10. CUSTOMER TELE DYNE McCORMICK SELPH
7 MJO NO. 773-2209
6 TEST ITEM SAFE / ARM DEVICE
5 PART NO. 06331-816780-3
4 SERIAL NO. 0002
3 DATE 6-14-77
2 INPUT LEVEL 22.9 GRMS (22.9 g rms)
ACCELEROMETER NO. 1
AXIS Y (ARMED Pos.)

10.2 LOCATION ON FIXTURE
8 BOOST LEVEL

PLOT #9



Report No. 773-2209

1.0

CUSTOMER TELEDYNE Mc CORNICK SELPH

MAJO NO. 773-2209

TEST ITEM SAFE/ARM DEVICE

PART NO. FIXTURE

SERIAL NO. NONE

DATE 6-14-77

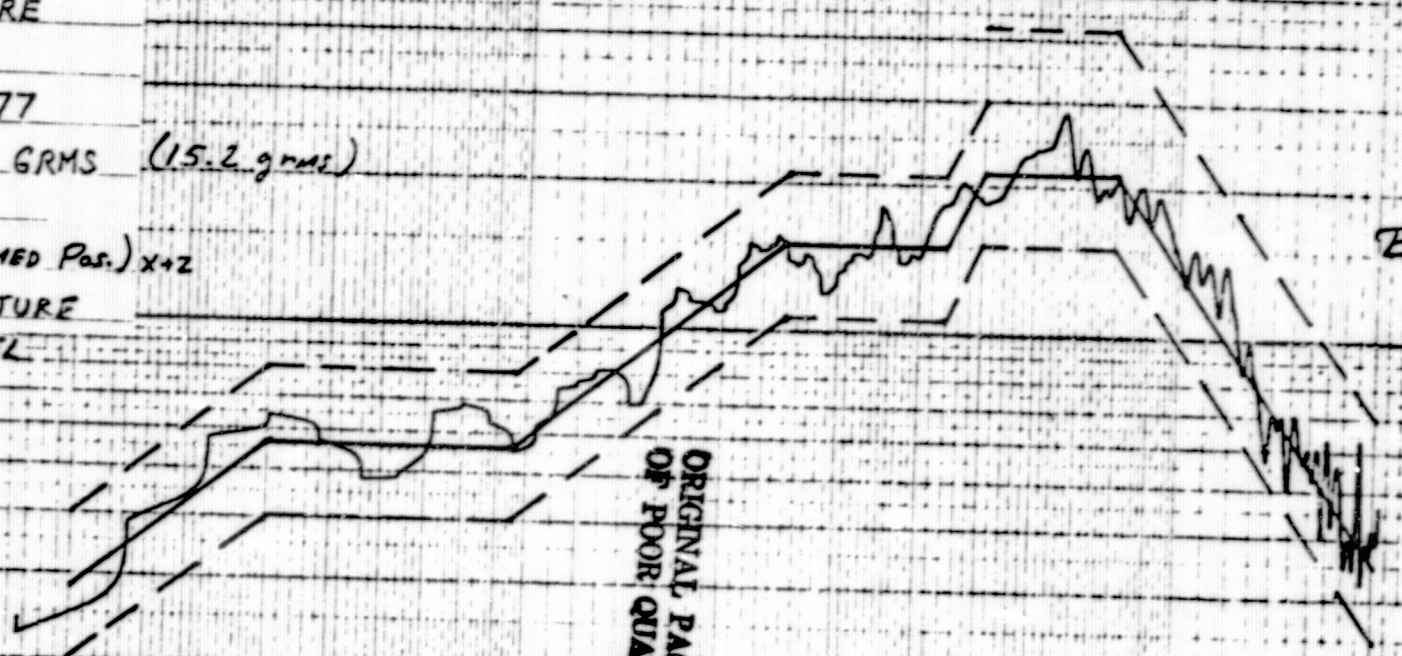
INPUT LEVEL 15.2 GRMS (15.2 grms)

ACCELEROMETER NO. 1

AXIS X,Z (ARMED POS.) X+Z

LOCATION ON FIXTURE

BOOST LEVEL



EQUALIZATION

PLOT # 10

ORIGINAL PAGE IS
OF POOR QUALITY

- 24 -

0.05

Report No. 773-2209

CUSTOMER *TELEDYNE Mc Cormick Selph*

MJO NO. *773-2209*

TEST ITEM *SAFE/ARM DEVICE*

PART NO. *06331-816780-3*

SERIAL NO. *0001 + 0002*

DATE *6-14-77*

INPUT LEVEL *15.2 GRMS (15.2 grms)*

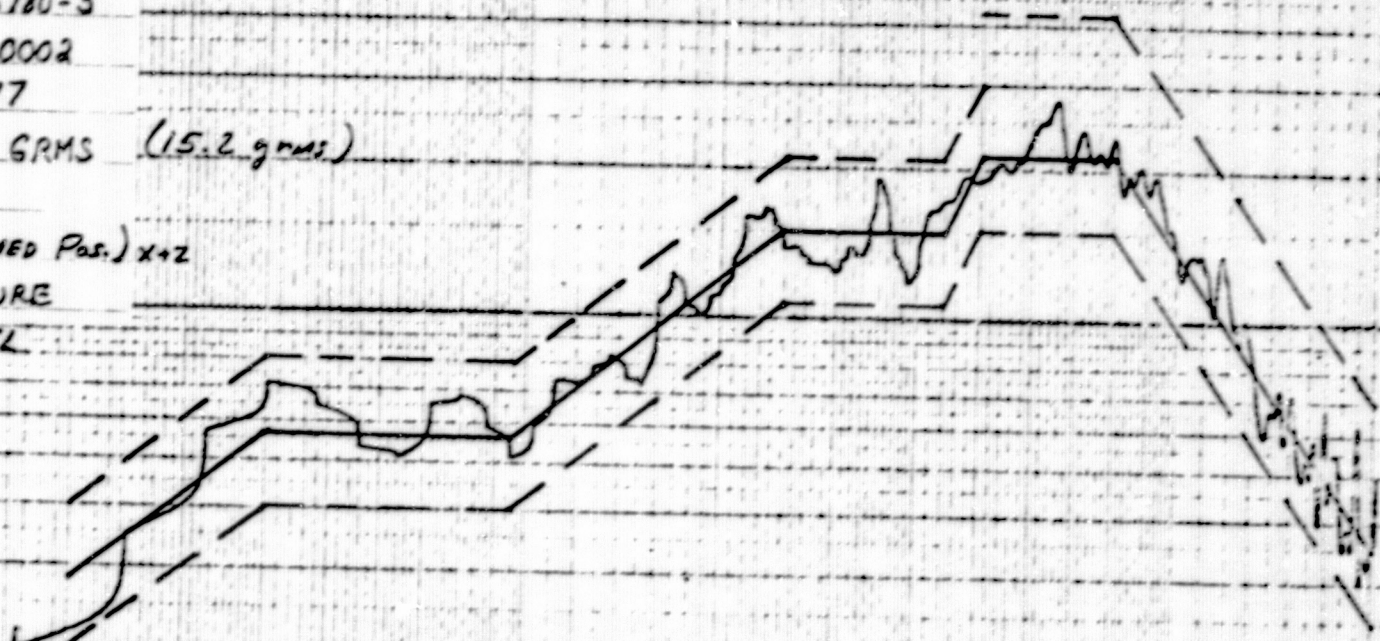
ACCELEROMETER NO. *1*

AXIS *X* (ARMED POS.) *X+Z*

LOCATION *ON FIXTURE*

BOOST LEVEL

PLOT # 11



CUSTOMER TELEDYNE Mc Cormick Selph

WJO NO. 773-2209

TEST ITEM SAFE/ARM DEVICE

PART NO. 06331-816780-3

SERIAL NO. 0001 + 0002

DATE 6-14-77

INPUT LEVEL 15.2 GRMS (15.2 g rms)

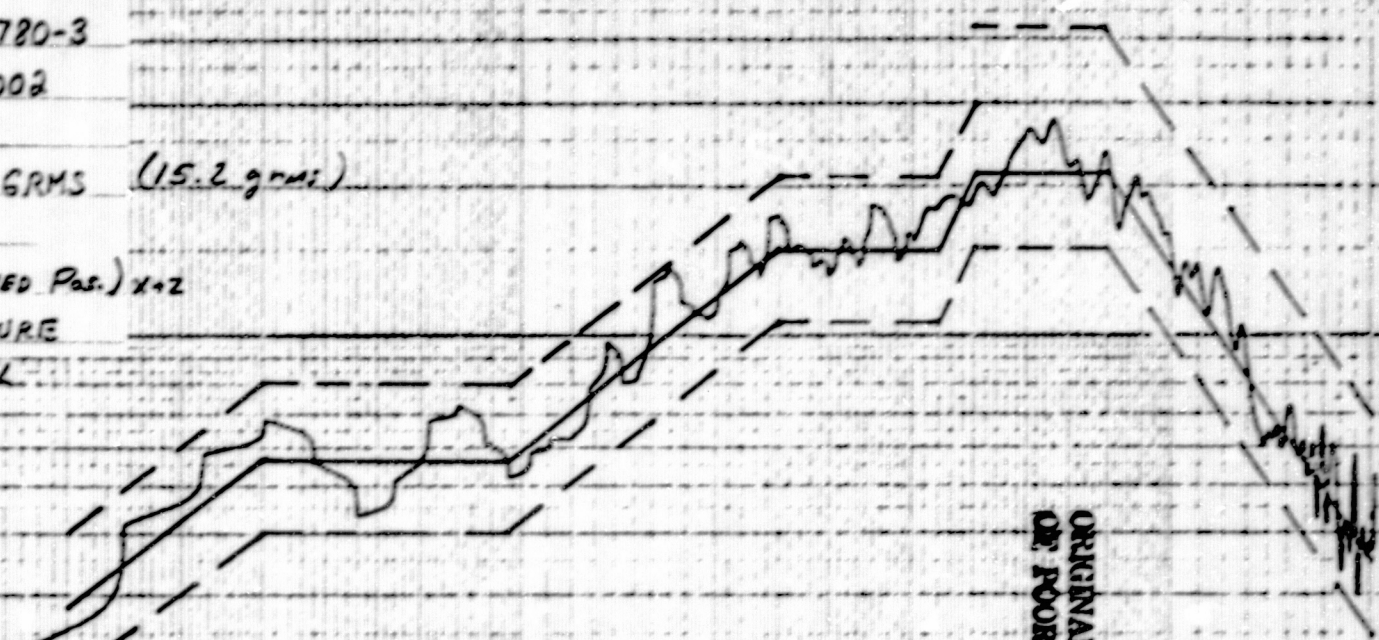
ACCELEROMETER NO. 1

AXIS Z (ARMED POS.) X+Z

LOCATION ON FIXTURE

PLOT # 12

BOOST LEVEL



ORIGINAL PAGE IS
OF POOR QUALITY

Report No. 773-2209

5 6 7 8 9 10

2

3

4

5

6

7

8

9

100

2

3

4

5

6

7

8

9

1000

2

3

4

FORM 1002-X-34 NOV 12-71

FREQUENCY - (CPS)

10

CUSTOMER TELEDYNE McCORMICK SELPHMJO NO. 773-2209TEST ITEM SAFE/ARM DEVICEPART NO. 06331-816780-3SERIAL NO. FIXTUREDATE 6-14-77INPUT LEVEL 11.9 GRMS 11.9ACCELEROMETER NO. 1AXIS Y (SAFE POS.)LOCATION ON FIXTUREREENTRY LEVEL

EQUALIZATION

Plot # 13

0.1

27

0.1

Report No. 773-2209

5 6 7 8 9 10

2

3

4

5

6

7

8

9

100

2

3

4

5

6

7

8

9

1000

2

3

4

FREQUENCY - (CPS)

FORM 1002-R-24 NEW 12-71

CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2209

TEST ITEM SAFE/ARM DEVICE

PART NO. 06331-816780-3

SERIAL NO. 0002

DATE 6-14-77

INPUT LEVEL 11.9 GRMS 11.9

ACCELEROMETER NO. 1

AXIS Y (SAFE Pos.)

LOCATION ON FIXTURE

REENTRY LEVEL

PLOT # 14

5 6 7 8 9 10

2

3

4

5

6

7

8

9

100

2

3

4

5

6

7

8

9

1000

2

3

4

FREQUENCY - (CPS)

FORM 1002-K-34 NEW 12-71

Report No. 773-2209

1.0

9
8
7
6
5
4
3
2
1
0.1
0.01
0.001

CUSTOMER TELEDYNE McCORMICK SERAPH
MJO NO. 773-2209
TEST ITEM SAFE/ARM DEVICE
PART NO. 06331-816780-3
SERIAL NO. 0001
DATE 6-14-77
INPUT LEVEL 11.9 GRMS 11.9
ACCELEROMETER NO. 1
AXIS Y (SAFE Pos.)
LOCATION ON FIXTURE

REENTRY LEVEL

ORIGINAL PAGE IS
OF POOR QUALITY

Plot # 15

APL
70
SC

- 29 -

Report No. 773-2209

5 6 7 8 9 10 2 3 4 5 6 7 8 9 100 2 3 4 5 6 7 8 9 1000 2 3 4

FORM 1002-X-34 NEW 12-71

FREQUENCY - (CPS)

10.1

CUSTOMER *Teledyne McCormick Selph*
MJO NO *773-2209*
TEST ITEM *Safe / Arm Device*
PART NO *FIXTURE*
SERIAL NO *NONE*
DATE *6-14-77*
INPUT LEVEL *12.2 GRMS* *12.2*
ACCELEROMETER NO *1*
AXIS *X, Z (safe position)* *X+Z*
LOCATION *ON FIXTURE*

EQUALIZATION
Plot # 16

10.3

30

10.2

Report No. 773-2209

Reentry level

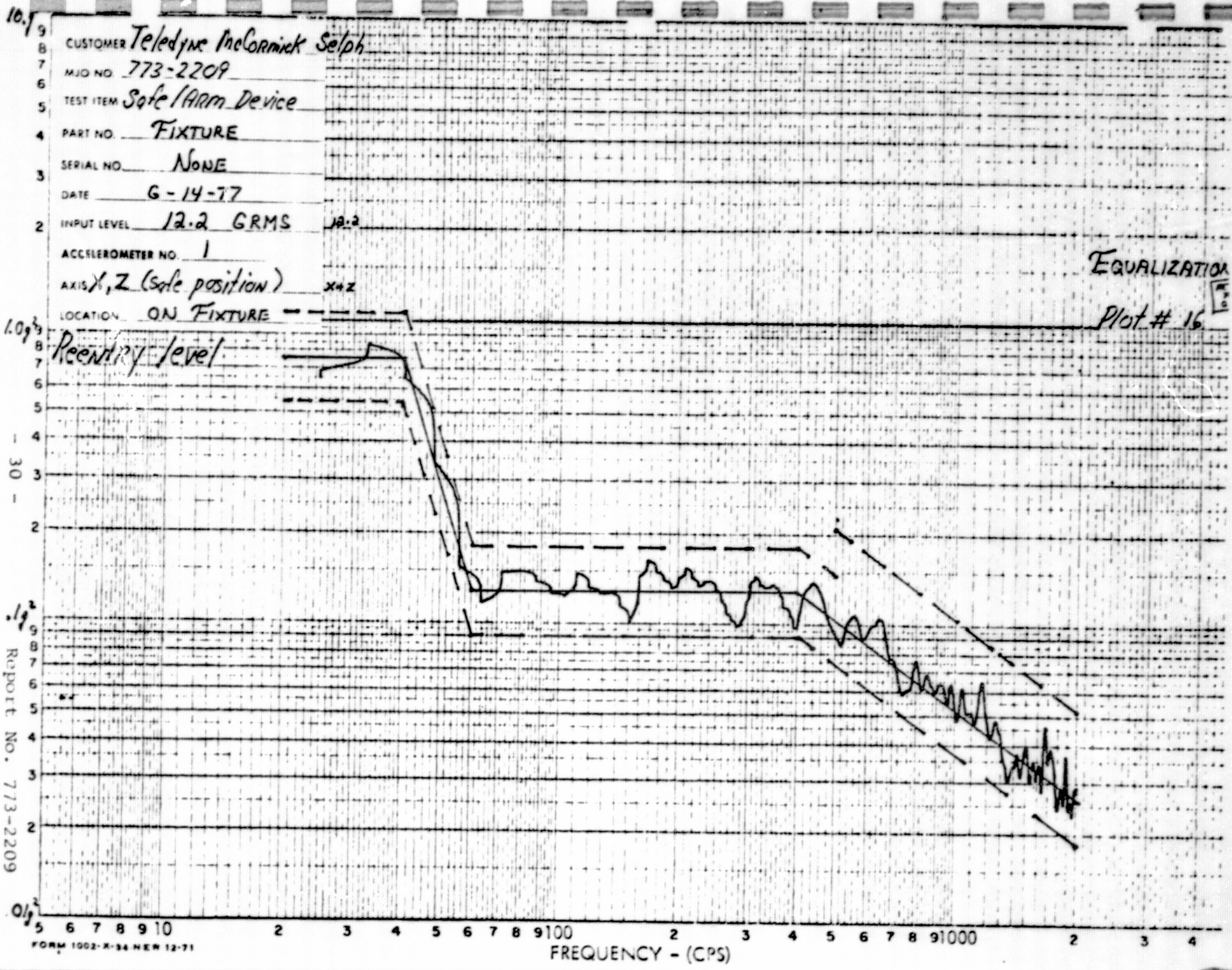
5 6 7 8 9 10

2 3 4 5 6 7 8 9 100

2 3 4 5 6 7 8 9 1000

2 3 4

FREQUENCY - (CPS)



10.

CUSTOMER *Teledyne McCormick Selph*

MJO NO. *773-2209*

TEST ITEM *Safe/Arm Device*

PART NO. *06331-816780-3*

SERIAL NO. *0001 + 0002*

DATE *6-14-77*

INPUT LEVEL *12.2 GRMS*

12.2

ACCELEROMETER NO. *1*

AXIS *X (safe position)*

X+Z

LOCATION *ON FIXTURE*

10.

Reentry level

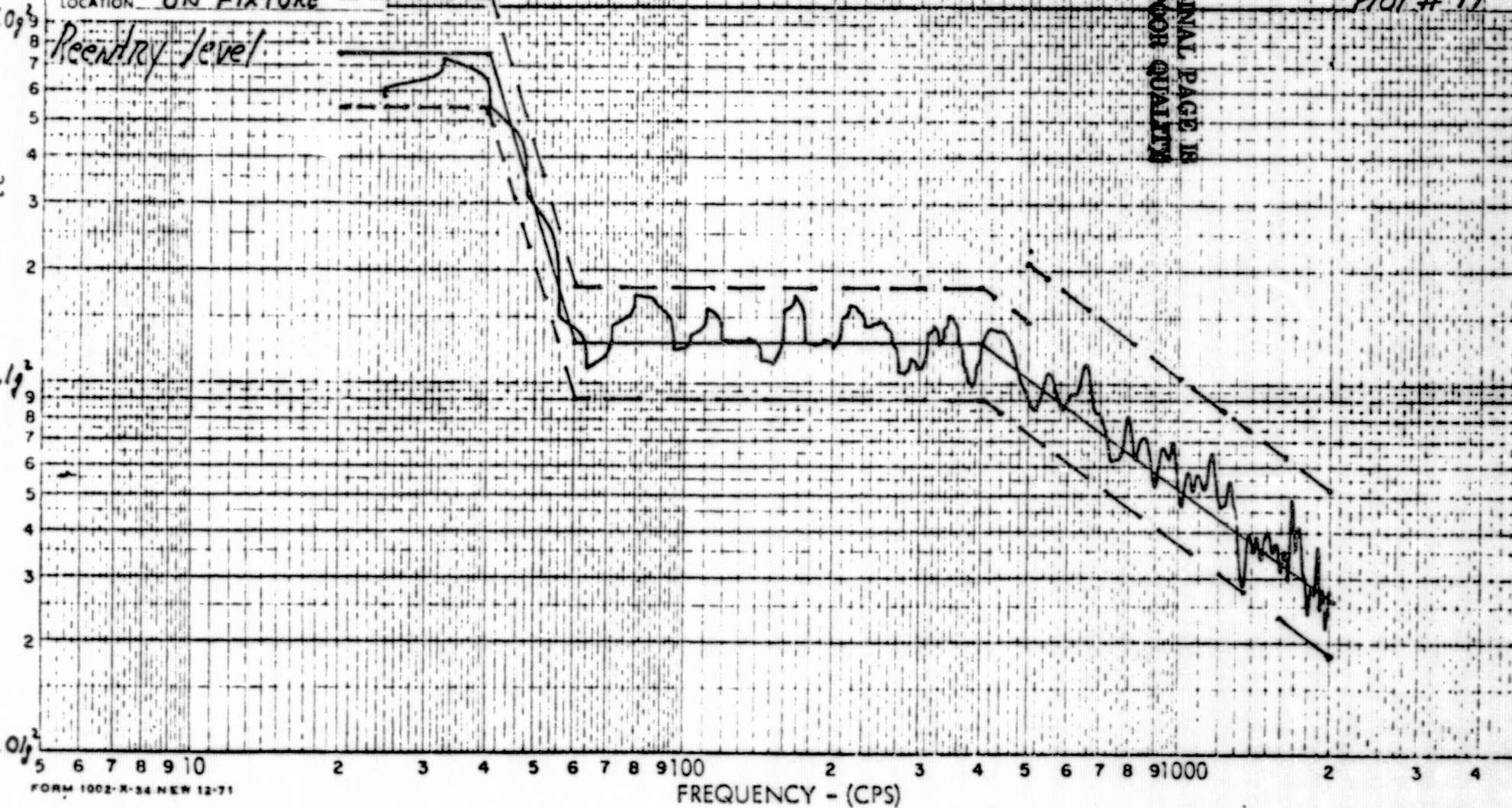
ORIGINAL PAGE IS
OF POOR QUALITY

Plot # 17

- 31 -

10.

Report No. 773-2209



10.

CUSTOMER *Teledyne McCormick Selph*MJO NO. *773-2209*TEST ITEM *Safe / ARM Device*PART NO. *06331-816780-3*SERIAL NO. *0001 + 0002*DATE *6-14-77*INPUT LEVEL *12.2 GRMS*ACCELEROMETER NO. *1*AXIS *Z (safe position)*LOCATION *ON FIXTURE*Plot # *18**Reentry level*

- 32 -

10.

Report No. 773-2209

5 6 7 8 9 10

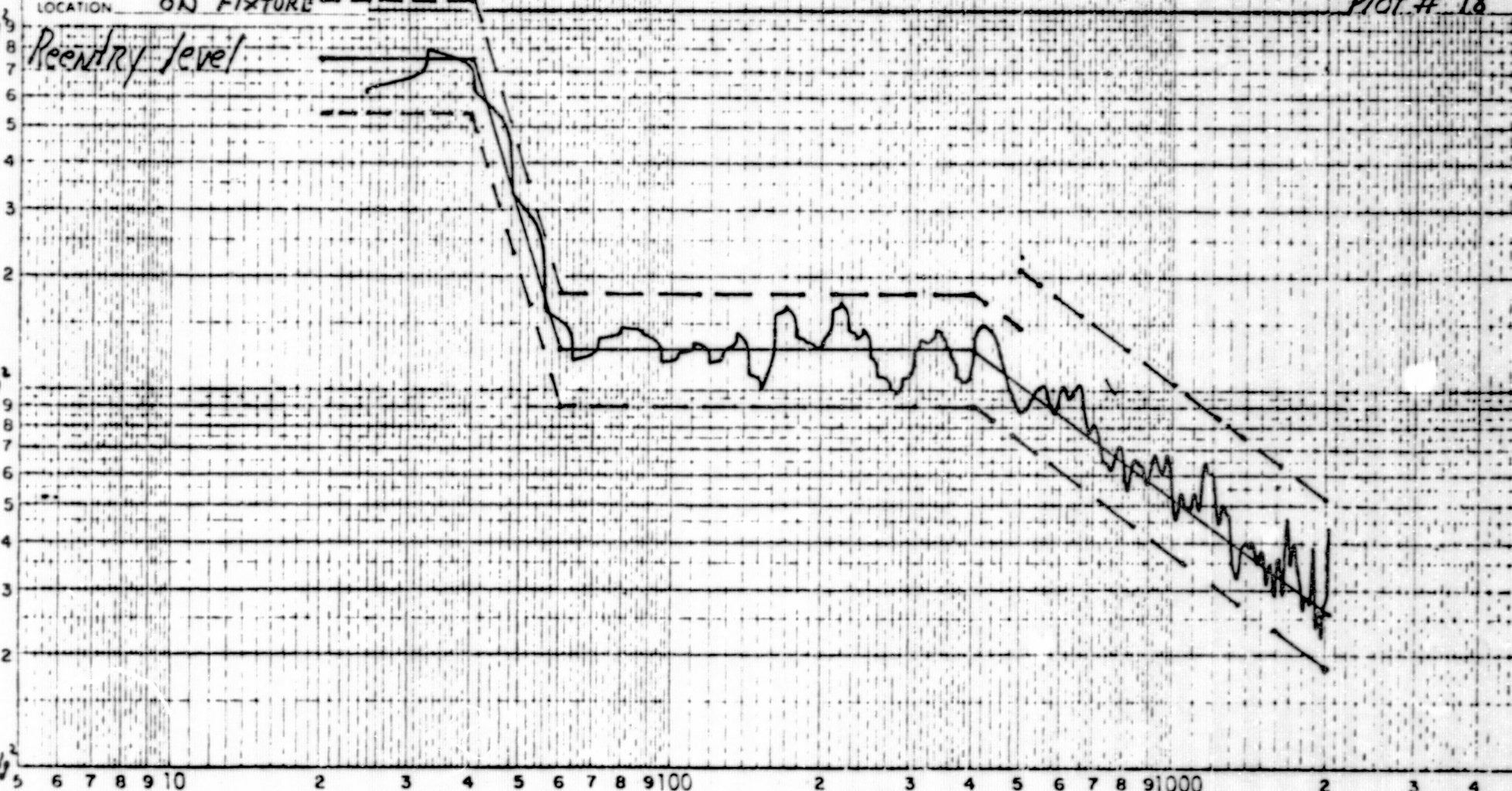
2 3 4 5 6 7 8 9 100

2 3 4 5 6 7 8 9 1000

2 3 4

FREQUENCY - (CPS)

FORM 1002-X-34 NEW 12-71



FACTUAL DATA3.0 ORDNANCE SHOCK TEST3.1 REFERENCES AND REQUIREMENTS

TMc/S DTP 816780A, paragraph 8.4 and Table V.

3.2 ITEMS TESTED - S & A S/N's 0003 and 0004.3.3 TEST PROCEDURE3.3.1 Installation

The test items were mounted on flat plate test fixtures mounted on a cube-type intermediate fixture attached to the vibration machine, as illustrated in Photograph No. 1. The specified torque valve was employed to mount the items. The items were tested together in the X and Z axes as shown, but were tested individually in the Y axis on the top of the cube.

3.3.2 Test Conditions (TMc/S Functions)

The test items were set in the SAFE position and monitored for rotation in excess of 7.5° during the shocks. Following the shocks in each axis the S & A was cycled from SAFE to ARMED to SAFE, and the rotation was timed.

3.3.3 Shock Spectrum

The vibration system was set up and equalized for the following shock spectrum with the fixture configuration mounted on the vibrator.

<u>Frequency (Hz)</u>	<u>Level</u>
5 - 100	+12 db/octave increase
100	94 g peak
100 - 4000	+6 db/octave increase
4000 - 10,000	1875 g peak



FACTUAL DATA

3.3.4 Tolerances

The tolerances on the spectrum were ± 3 db.

3.3.5 Shocks

3.3.6 Analysis and Data Recording

The spectrum in each shock was analyzed in the maxi-max mode with a real time analyzer and recorded on an X-Y recorder, g level versus frequency.

3.4 RESULTS

There was no reported malfunction during or following the shocks and no visible evidence of damage resulting from the test.

3.5 DESCRIPTION OF TEST APPARATUS

See Appendix 1.

3.6 PHOTOGRAPH

See Appendix 2, Photograph No. 1.

3.7 TEST DATA

One exposure data sheet and 9 X-Y recordings are included. Functional data were retained by TMC/S.

Date Started: 6-14-77		TEST DATA								Performed By: G.W. CAYER	
Date Completed: 6-14-77		Specimen Description: SAFE/ARM DEVICE 06331-816780-3				Test: SHOCK SPECTRA				AETL Q.A. 	
Temp: AMB	Humidity: —	Customer: TELEDYNE Mc CORMICK SELPH				Test Spec. D.T.P. 816780 PARA. 8.4.4				J/N 773-2209	

Date	Time	Analyzed Pulse +	Primary	Analyzed Pulse -	Primary	Analyzed	Maxi-Max	Number of Pulses	Axis	Discontinuities	"Q" Factor = 2(1/2 % Damping)	Plot No.	Sample Serial No.	Comment
Day	Hour	Noted	Noted	Noted	Noted									Specified
6-14-77	1600	—	—	✓	N/A	X,Y,Z	NONE	10		1			FIXTURE	EQUALIZATION
	1607	—	—	✓	1	Z				2			0003 0004	RUN
	1609	—	—	✓	1	Z				3			0003 0004	RUN
	1614	—	—	✓	1	X				4			0003 0004	RUN
	1616	—	—	✓	1	X				5			0003 0004	RUN
	1621	—	—	✓	1	Y				6			0003	RUN
	1623	—	—	✓	1	Y				7			0003	RUN
✓	1628	—	—	✓	1	Y	Y	Y		8			0004	RUN
6-14-77	1629	—	—	✓	1	Y	NONE	10		9			0004	RUN

NOTE: EACH SAFE/ARM DEVICE WAS CHECKED FOR NO ROTOR ROTATION GREATER THAN 7.5° DURING SHOCK, AND FOR ELAPSED TIME FOR EACH 90° ROTATION AFTER SHOCK IN EACH AXIS. THIS WAS PERFORMED BY THE CUSTOMER WITH CUSTOMER SUPPLIED TEST EQUIPMENT.

J/N 773-2209

Run No. 1

CUSTOMER TELEDYNE McCORMICK SELPH

DATE 6-14-77

SPECIMEN S/N

FIXTURE

P/N 06331-816780-3

ACCEL. No. 1

CONTROL ☒

RESPONSE ☐

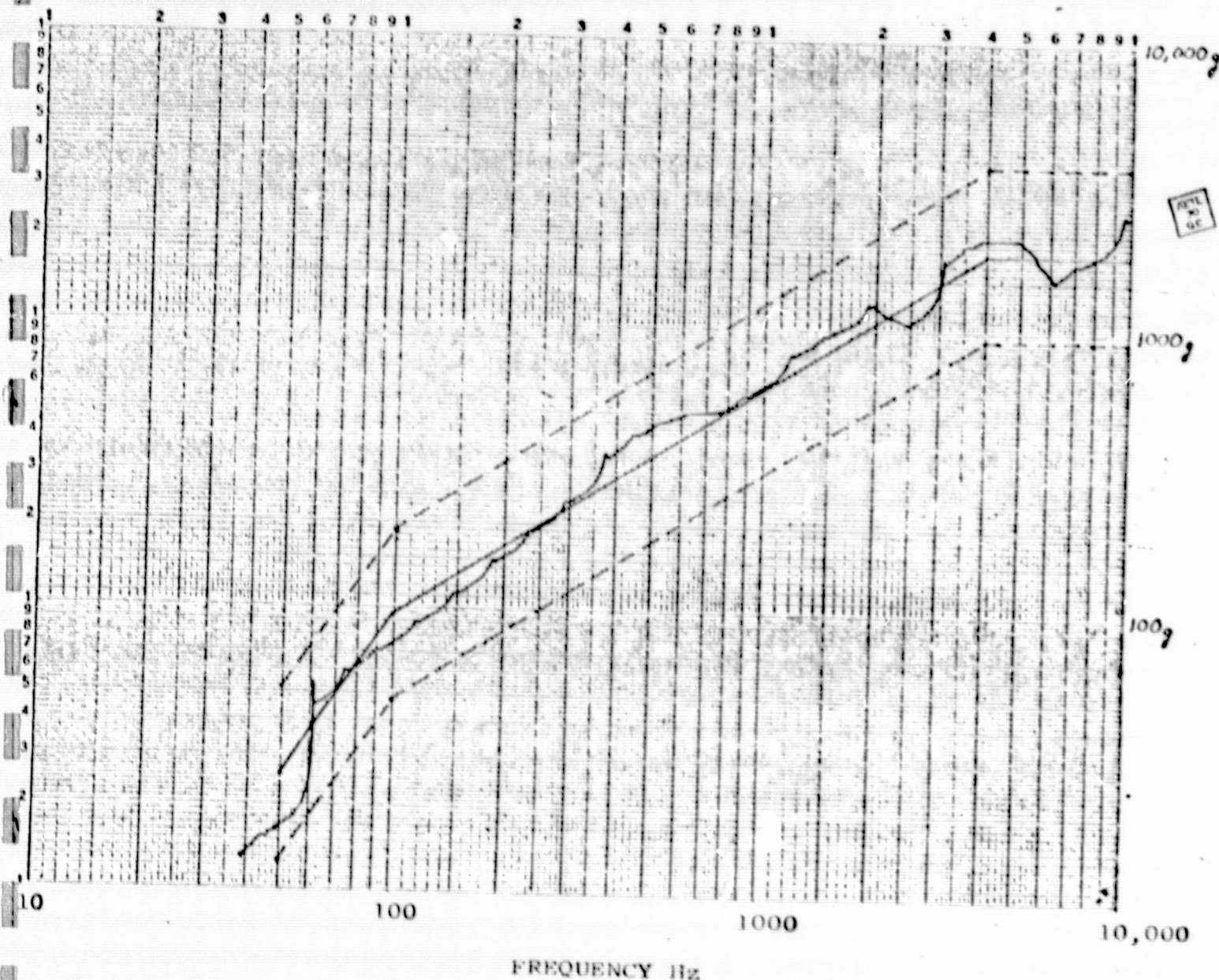
TECHNICIAN G.W. CAYER

AXIS X, Y, Z

FULL SCALE 10,000g PK

ORIGINAL PAGE IS
OF POOR QUALITY

EQUALIZATION
SHOCK SPECTRUM



J/N 773-2209

Run No. 2

CUSTOMER TELEDYNE McCORMICK SELPH

DATE 6-14-77

SPECIMEN S/N 0003 + 0004

P/N 06331-816780-3

ACCEL. No. 1

CONTROL (✓)

RESPONSE ()

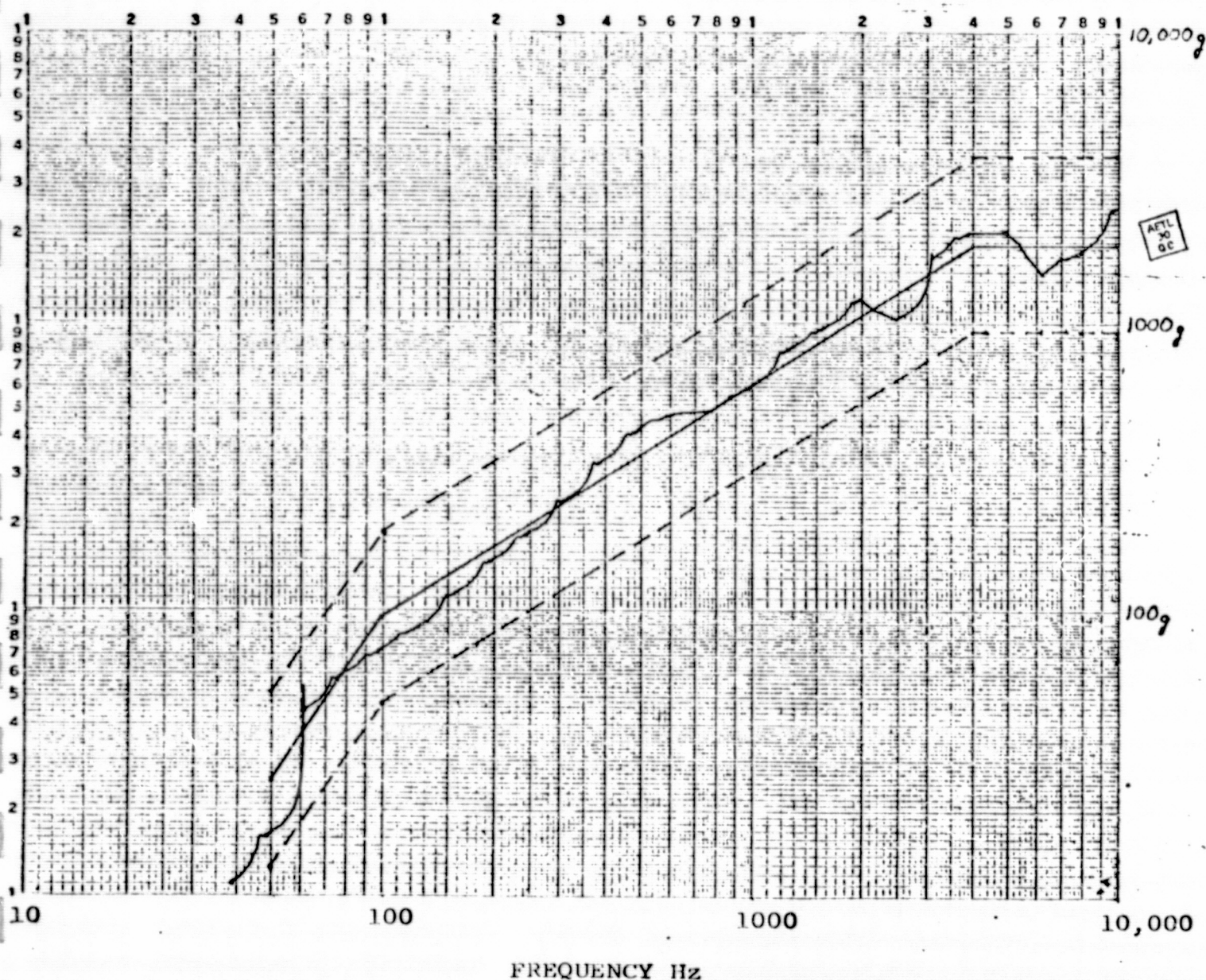
TECHNICIAN G.W. CAYER

AXIS Z

FULL SCALE 10,000g PK

SHOCK SPECTRUM

ORIGINAL PAGE IS
OF POOR QUALITY



J/N 773-2209

Run No. 3

CUSTOMER *TELEDYNE McCORMICK SELPH*

DATE 6-14-77

SPECIMEN S/N 0003 + 0004 :

P/N 06331-816780-3

ACCEL. No. 1

CONTROL (✓)

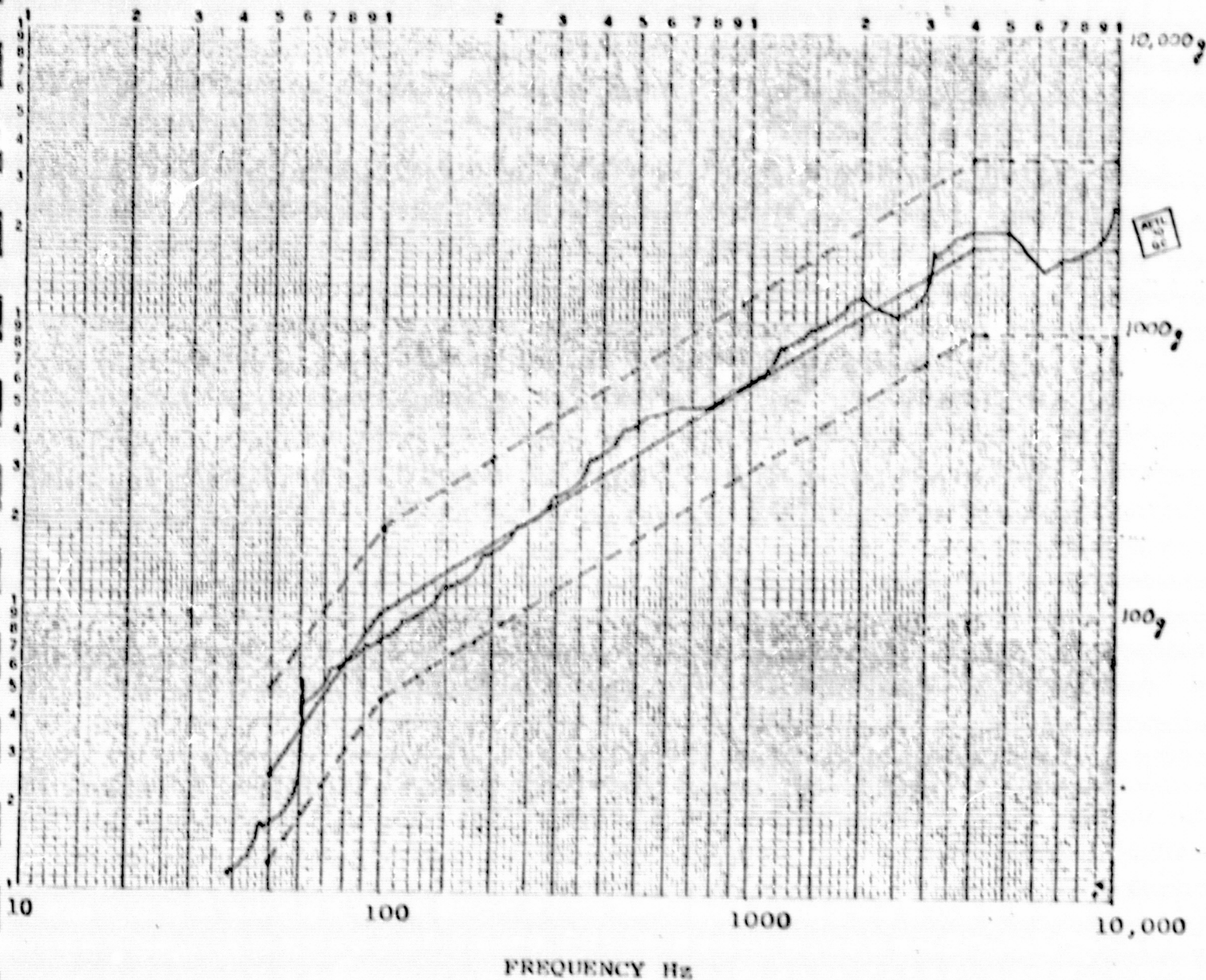
RESPONSE ()

TECHNICIAN *G.W. CAYER*

AXIS Z

FULL SCALE 10,000g PK

SHOCK SPECTRUM



J/N 773-2209

Run No. 4

CUSTOMER TELEDYNE McCORMICK SELPH

DATE 6-14-77

SPECIMEN S/N 0003 + 0004

P/N 06331-816780-3

ACCEL. No. 1

CONTROL ☒

RESPONSE ☐

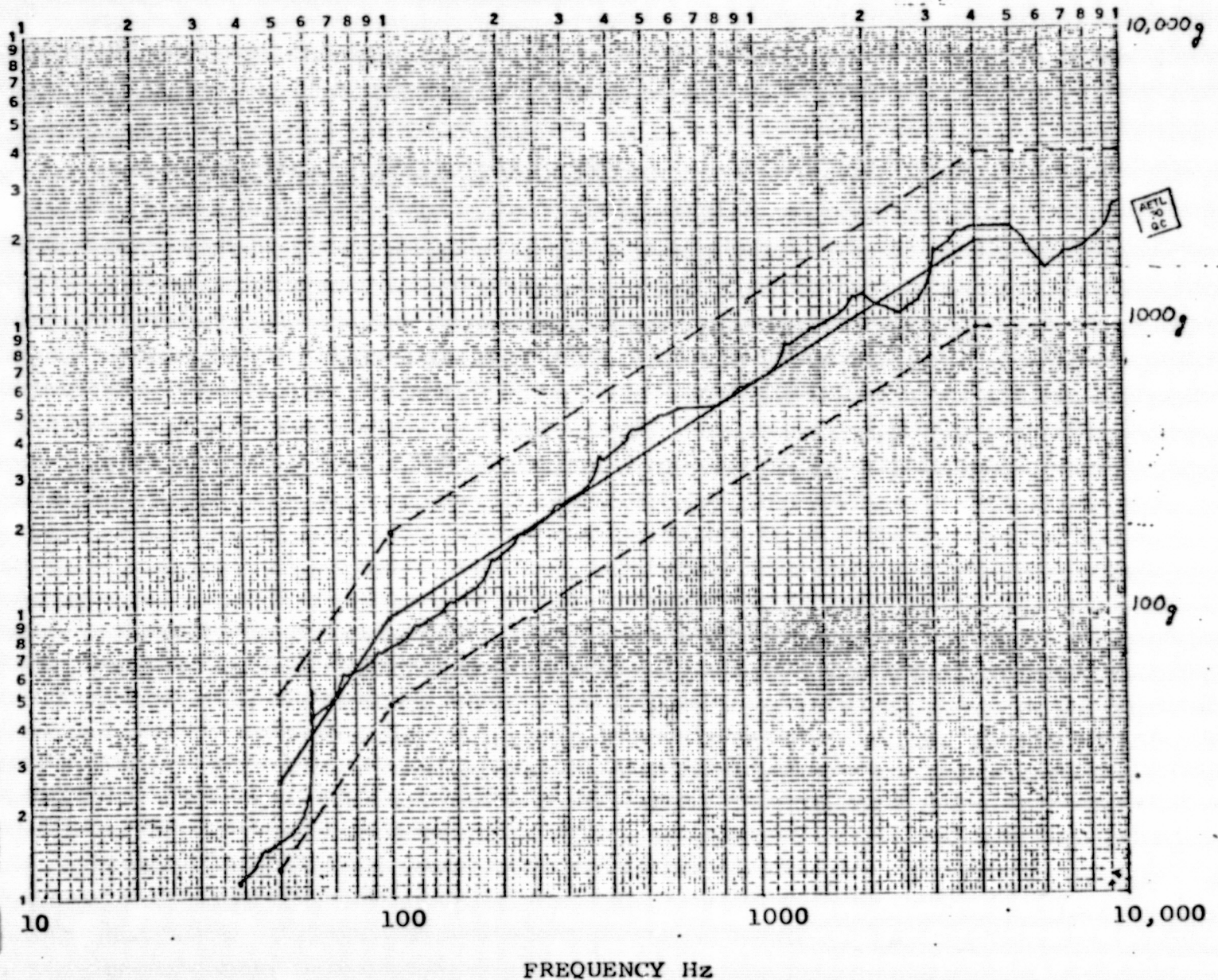
TECHNICIAN G.W. CAYER

AXIS X

FULL SCALE 10,000g PK

ORIGINAL PAGE IS
OF POOR QUALITY

SHOCK SPECTRUM



J/N 773-2209

Run No. 5

CUSTOMER TELEDYNE McCORMICK SELPH

DATE

6-14-77

SPECIMEN S/N 0003 + 0004

P/N 06331-816780-3

ACCEL. No. 1

CONTROL ☒

RESPONSE ()

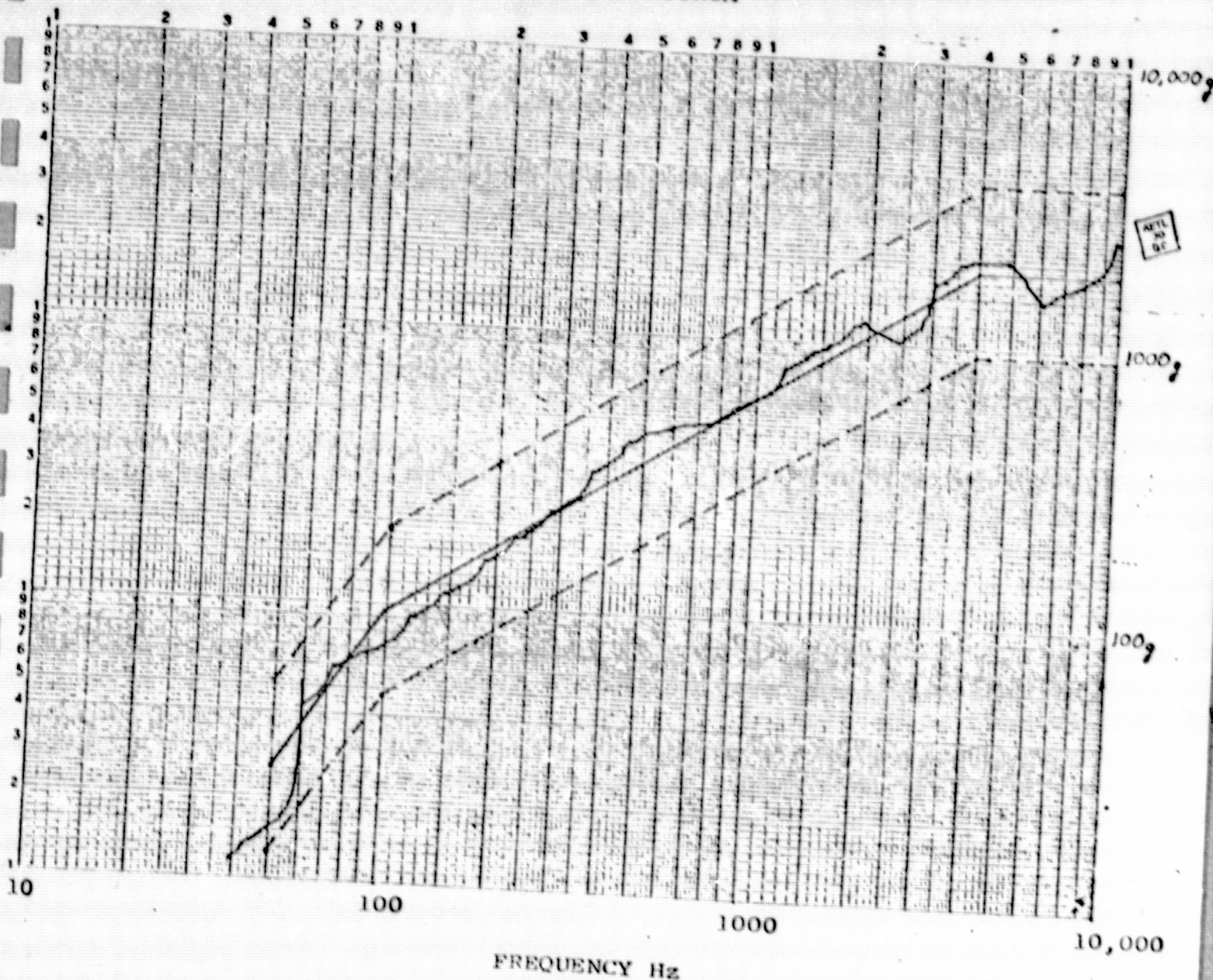
TECHNICIAN G.W. CAYER

AXIS

X

FULL SCALE 10,000g PK

SHOCK SPECTRUM



J/N 773-2209

Run No. 6

CUSTOMER TELEDYNE McCORMICK SELPH

DATE 6-14-77

SPECIMEN S/N 0003

P/N 06331-816780-3

ACCEL. No. 1

CONTROL ☒

RESPONSE ()

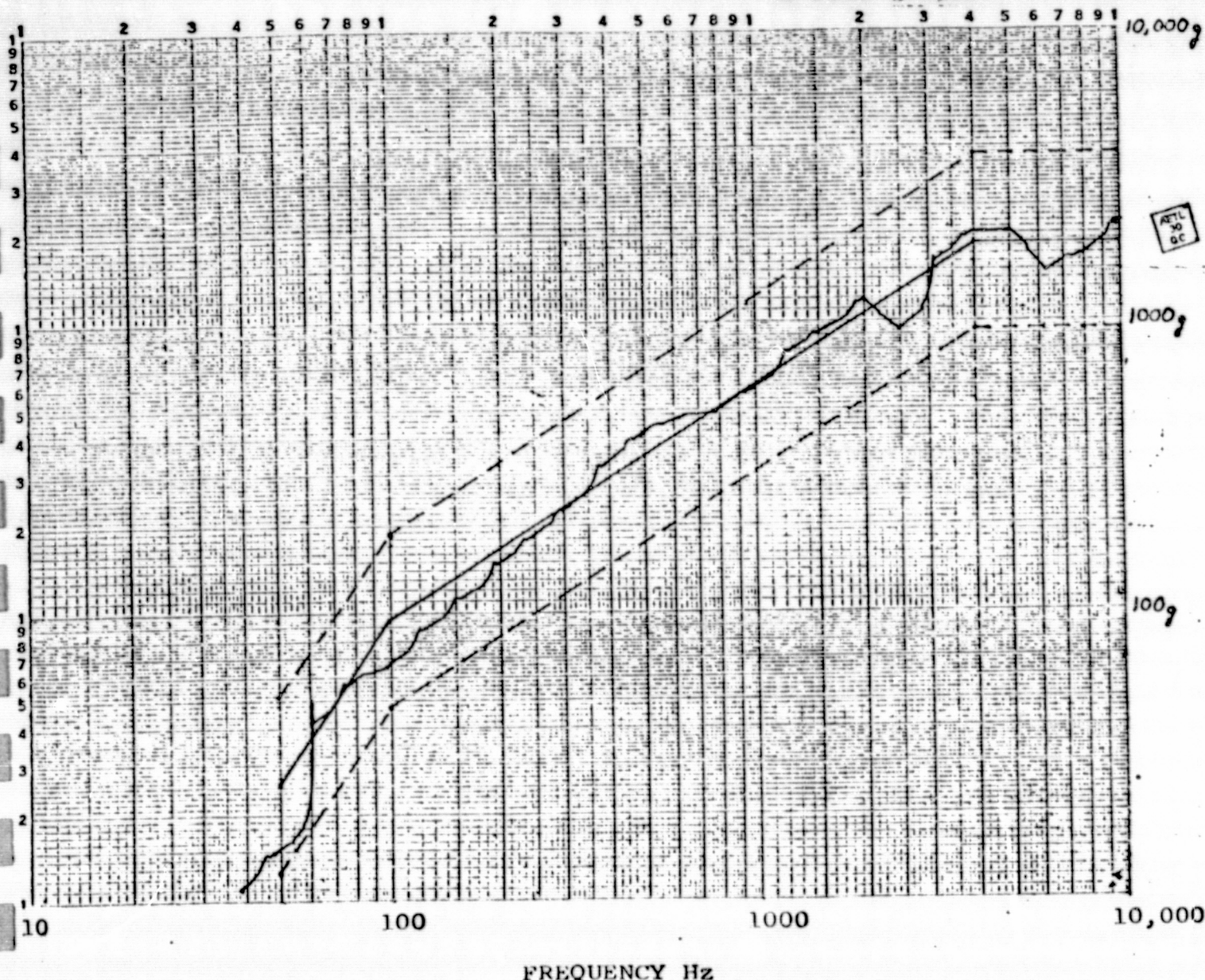
TECHNICIAN G.W. CAYER

AXIS Y

FULL SCALE 10,000g PK

SHOCK SPECTRUM

ORIGINAL PAGE IS
OF POOR QUALITY



J/N 773-2209

Run No. 7

CUSTOMER TELEDYNE McCORMICK SELPH

DATE 6-14-77

SPECIMEN S/N 0003

P/N 06331-816780-3

ACCEL. No. 1

CONTROL (✓)

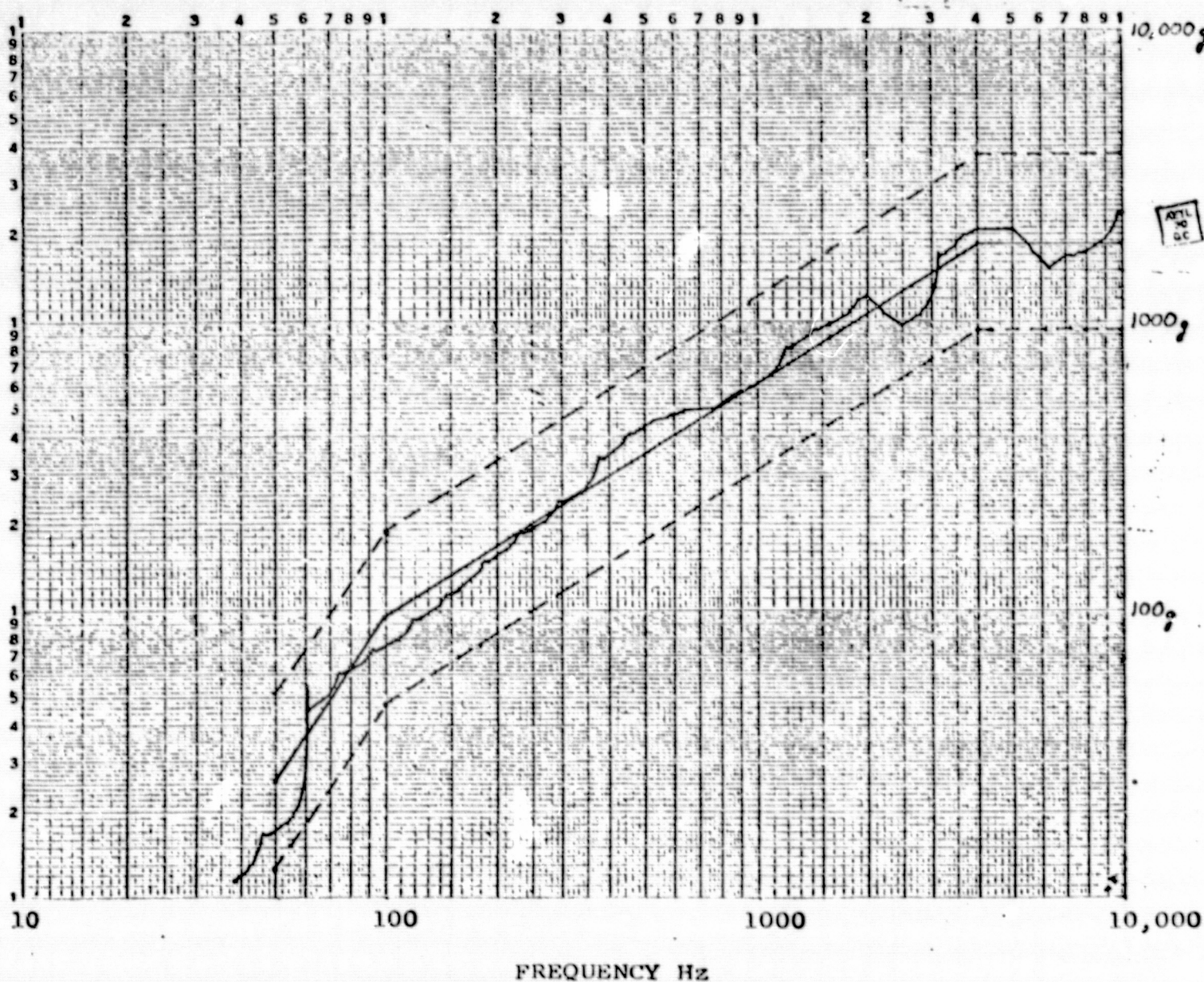
RESPONSE ()

TECHNICIAN G.W. CAYER

AXIS Y

FULL SCALE 10,000g PK

SHOCK SPECTRUM



J/N 773-2209

Run No. 8

CUSTOMER *TELEDYNE McCORMICK SELPH*

DATE *6-14-78*

SPECIMEN S/N *0004*

P/N *06331-816780-3*

ACCEL. No. *1*

CONTROL ☒

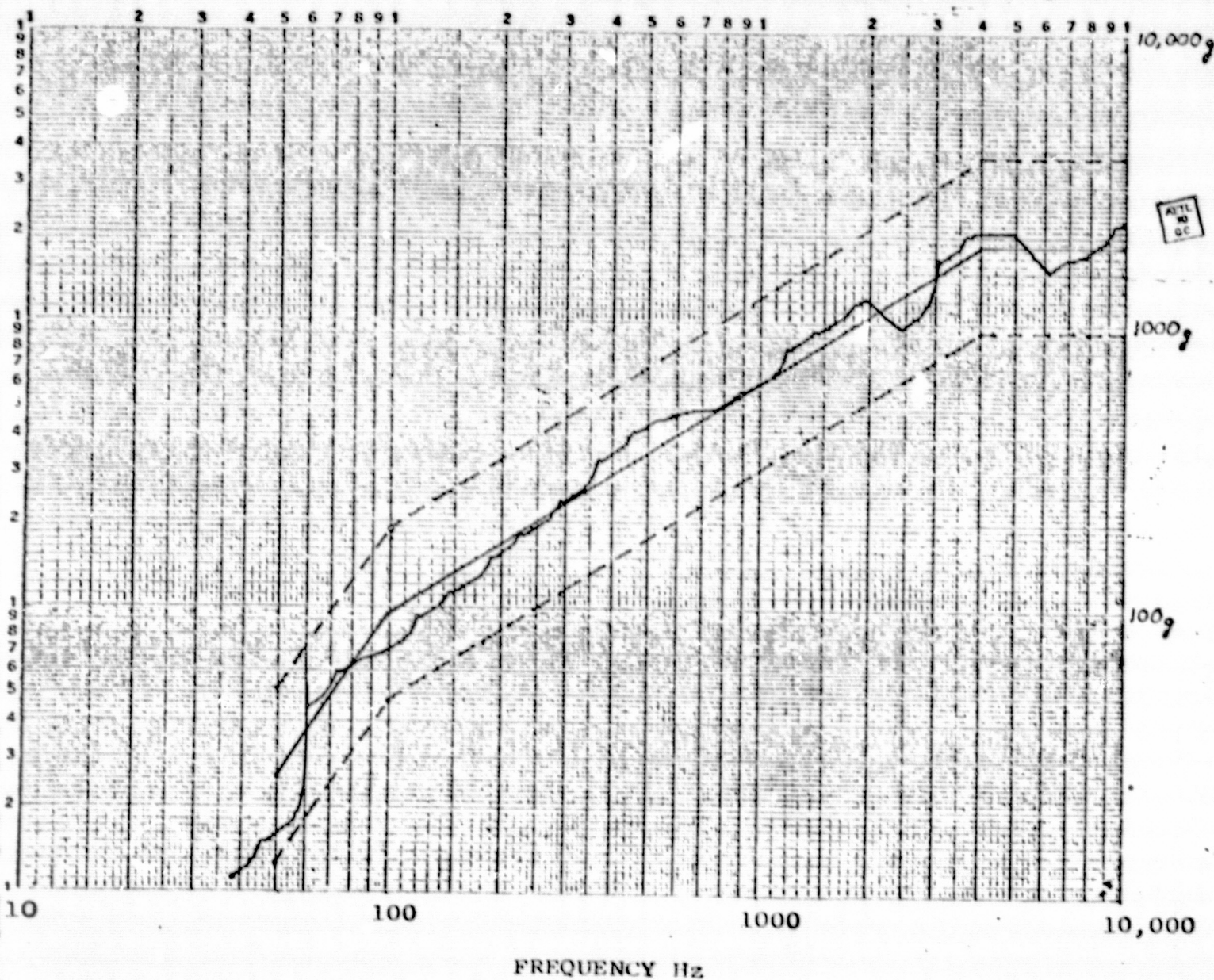
RESPONSE ☐

TECHNICIAN *G.W. CAYER*

AXIS *Y*

FULL SCALE *10,000g* PK

SHOCK SPECTRUM



J/N 773-2209

Run No. 9

CUSTOMER TELEDYNE McCORMICK SELPH DATE 6-14-77

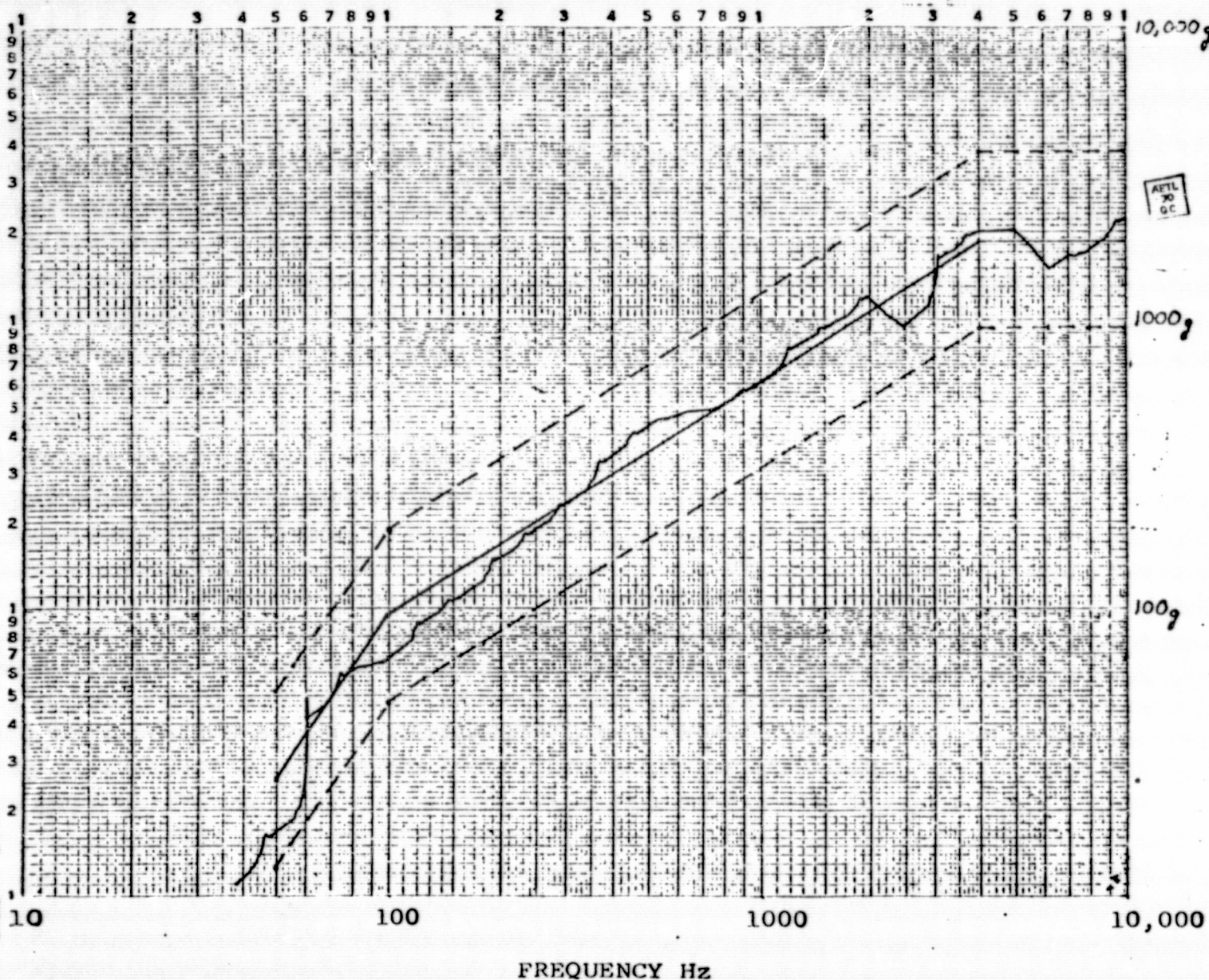
SPECIMEN S/N 0004 P/N 06331-816780-3

ACCEL. No. 1 CONTROL ☒ RESPONSE ☐

TECHNICIAN G.W. CAYER AXIS Y FULL SCALE 10,000g PK

SHOCK SPECTRUM

ORIGINAL PAGE IS
OF POOR QUALITY.





FACTUAL DATA

4.0 SRB WATER LANDING AND SRB PARACHUTE DEPLOYMENT SHOCK TESTS

4.1 REFERENCES AND REQUIREMENTS

TMc/S DTP 816780A, paragraph 8.4 and Table V.

4.2 ITEMS TESTED - S & A's S/N's 0003 and 0004.

4.3 TEST PROCEDURE

4.3.1 Installation

The test items were mounted on a flat-plate test fixture as shown in Photograph No. 2. The specified torque valve was used on the mounting bolts.

4.3.2 Test Conditions (TMc/S Functions)

The test items were set in the SAFE position and monitored for rotation in excess of 7.5° during the shocks. Following the shocks in each axis the S & A was cycled from SAFE to ARMED to SAFE, and the rotation was timed.

4.3.3 Calibration

The shock machine was calibrated for each shock with a dummy weight to simulate the mass of the test assembly.

4.3.4 Shocks

The test items were subjected to one half-sine shock in each direction of three orthogonal axes according to the following schedule.

FACTUAL DATAShock Schedule

<u>Test Axis</u>	<u>Amplitude (g)</u>	<u>Duration</u>	<u>Description</u>
Longitudinal $\pm$	30	150 ms	Water Landing
Lateral 1 $\pm$	20	100 ms	Water Landing
Lateral 2 $\pm$	20	100 ms	Water Landing
Longitudinal $\pm$	6	300 ms	Parachute Deployment
Lateral 1 $\pm$	11	300 ms	Parachute Deployment
Lateral 2 $\pm$	11	300 ms	Parachute Deployment

4.3.5 Data Recording

The accelerometer output was recorded on an oscillograph recorder, amplitude versus time.

4.4 RESULTS

There was no reported malfunction during or following the shocks and no visible evidence of damage resulting from the test.

4.5 DESCRIPTION OF TEST APPARATUS

See Appendix 1.

4.6 PHOTOGRAPH

See Appendix 2, Photograph No. 2.

4.7 TEST DATA

Four data sheets and reproductions of the shock impulses (except the last shock which was missed) are included. TMC/S retained functional data.

DATE STARTED: 6/14/77	SHOCK TEST DATA SHEET 1 of 4		TEST ENGINEER: BERRY F. MOORE
DATE COMPLETED: 6/14/77	CUSTOMER: TELEDYNE MCCORMICK SELF		Q. A.: ☒ ☐
TEMP.: HUMIDITY: Amb.	TEST ITEM: (2ea) Safe/Arm Device; P/N 10A00d65-103 Lot 4913-2 S/N 0003; Lot 4918-2 S/N 0004		G. S. I.: ☒ ☐
JOB NO.: 773-2209	SPECIFICATION: DTP 816780 SRB Water Landing Shock		Page 1 of

1 = Tested as Calibrated	Type of machine used: Drop ☒ Pendulum ☐
2 = Sawtooth	
3 = Half Sine	

Fixtured and Tested by Normal Mounting: YES ☒ NO ☐

Drop Run No.	Wave Shape	Shock Level (G's)	Duration (m.s.)	Direction of Shock	Shocks Applied per Dir.	Visual Exam. Post Test
3	30	150	Long.	1	yes	
Pre	3	30	150			
1	3	1	Long.	1	O.K.	
2	3	1	Long.	1	O.K.	

TEST RESULTS: There appeared to be no damage to the Test Items due to the shock test. The Customer performed operational tests after each axis had been shocked and reported no malfunction due to the applied shocks. The two items were tested together on one fixture.

COMMENTS:

Berry F. Moore
Berry F. Moore, Test Engineer

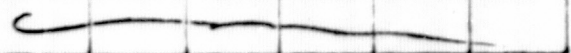
DATE STARTED: 6/14/77		SHOCK TEST DATA SHEET 2 of 4		TEST ENGINEER: Berry F. Moore	
DATE COMPLETED: 6/14/77		CUSTOMER: TELEDYNE MCCORMICK SELPH		Q. A.: 	
TEMP.: Amb.	HUMIDITY: Amb.	TEST ITEM: (2ea) Safe/Arm Device; P/N 10A00d65-103 Lot 4913-2 S/N 0003; Lot 4918-2 S/N 0004			G. S. I.:
JOB NO.: 773-2209		SPECIFICATION: DTP 816780 SRB Water Landing Shock			Page 1 of

- ***
- 1 = Tested as Calibrated
- 2 = Sawtooth
- 3 = Half Sine

Type of machine used: Bungee Accelerated
Drop ☒ Pendulum ☐

Fixtured and Tested by Normal Mounting: YES ☒ NO ☐

Drop Run No.	Wave Shape	Shock Level (G's)	Duration (m.s.)	Direction of Shock	Shocks Applied Per Dir.	Visual Exam. Post Test

3	20	100	Lat. 1,2,3,4	1	yes	
Pre	3	20	100			
1	3	*** 1	*** 1	Lat.1	1	O.K.
2	3	1	1	Lat.2	1	O.K.
3	3	1	1	Lat.3	1	O.K.
4	3	1	1	Lat.4	1	O.K.
						
						

SPECIFIED

CALIBRATED
(Dummy Load)

TEST RESULTS: There appeared to be no damage to the Test Items due to the shock test. The Customer performed operational tests after each axis had been shocked and reported no malfunction due to the applied shocks. The two items were tested together on one fixture.

COMMENTS:


Berry F. Moore, Test Engineer

DATE STARTED: 6/14/77		SHOCK TEST DATA SHEET 3 of 4	TEST ENGINEER: Berry F. Moore
DATE COMPLETED: 6/14/77		CUSTOMER: TELEDYNE MCCORMICK SELPH	Q. A.: 
TEMP.: Amb.	HUMIDITY: Amb.	TEST ITEM: (2ea) Safe/Arm Device; P/N 10A00d65-103 Lot 4913-2 S/N 0003; Lot 4918-2 S/N 0004	G. S. I.:
JOB NO.: 773-2209		SPECIFICATION: DTP 816780 SRB Parachute Deployment	Page 1 of

- ***
- 1 = Tested as Calibrated
- 2 = Sawtooth
- 3 = Half Sine

Type of machine used: Bungee Accelerated ☒ Pendulum ☐

Fixtured and Tested by Normal Mounting: YES ☒ NO ☐

	Drop Run No. Wave Shape	Shock Level (G's)	Duration (m.s.)	Direction of Shock	Shocks Applied per Dir.	Visual Exam. Post Test
***	3	6	300	Long. +&-	1	yes
Pre	3	6	300			
1	3	1	1	Long.	1	O.K.
2	3	1	1	Long.	1	O.K.

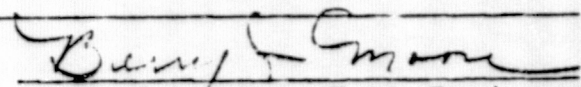
SPECIFIED

CALIBRATED
(Dummy Load)

ORIGINAL PAGE IS
OF POOR QUALITY

TEST RESULTS: There appeared to be no damage to the Test Items due to the shock test. The Customer performed operational tests after each axis had been shocked and reported no malfunction due to the applied shocks. The two items were tested together on one fixture.

COMMENTS:


Berry F. Moore, Test Engineer

DATE STARTED: 6/14/77		SHOCK TEST DATA SHEET 4 of 4		TEST ENGINEER: Berry F. Moore	
DATE COMPLETED: 6/14/77		CUSTOMER: TELEDYNE MCCORMICK SELPH		Q. A.: ☒	
TEMP.: Amb.	HUMIDITY: Amb.	TEST ITEM: (2ea) Safe/Arm Device; P/N 10A00d65-103 Lot 4913-2 S/N 0003; Lot 4918-2 S/N 0004		G. S. I.:	
JOB NO.: 773-2209		SPECIFICATION: DTP 816780 SRB Parachute Deployment		Page 1 of	
***		Bungee Accelerated			
1 = Tested as Calibrated		Type of machine used: Drop ☒ Pendulum ☐			
2 = Sawtooth		Fixtured and Tested by Normal Mounting: YES ☒ NO ☐			
3 = Half Sine					

Drop Run No.	Wave Shape	Shock Level (G's)	Duration (m.s.)	Direction of Shock	Shocks Applied per Dir.	Visual Exdm. Post Test
*** 3	11	300	Lat. 4 1,2,3,	1	yes	
Pre	3	11	300			
1	3	1	1	Lat. 1	1	O.K.
2	3	1	1	Lat. 2	1	O.K.
3	3	1	1	Lat. 3	1	O.K.
4	3	1	1	Lat. 4	1	O.K.

SPECIFIED

CALIBRATED
(Dummy Load)

TEST RESULTS: There appeared to be no damage to the Test Items due to the shock test. The Customer performed operational tests after each axis had been shocked and reported no malfunction due to the applied shocks. The two items were tested together on one fixture.

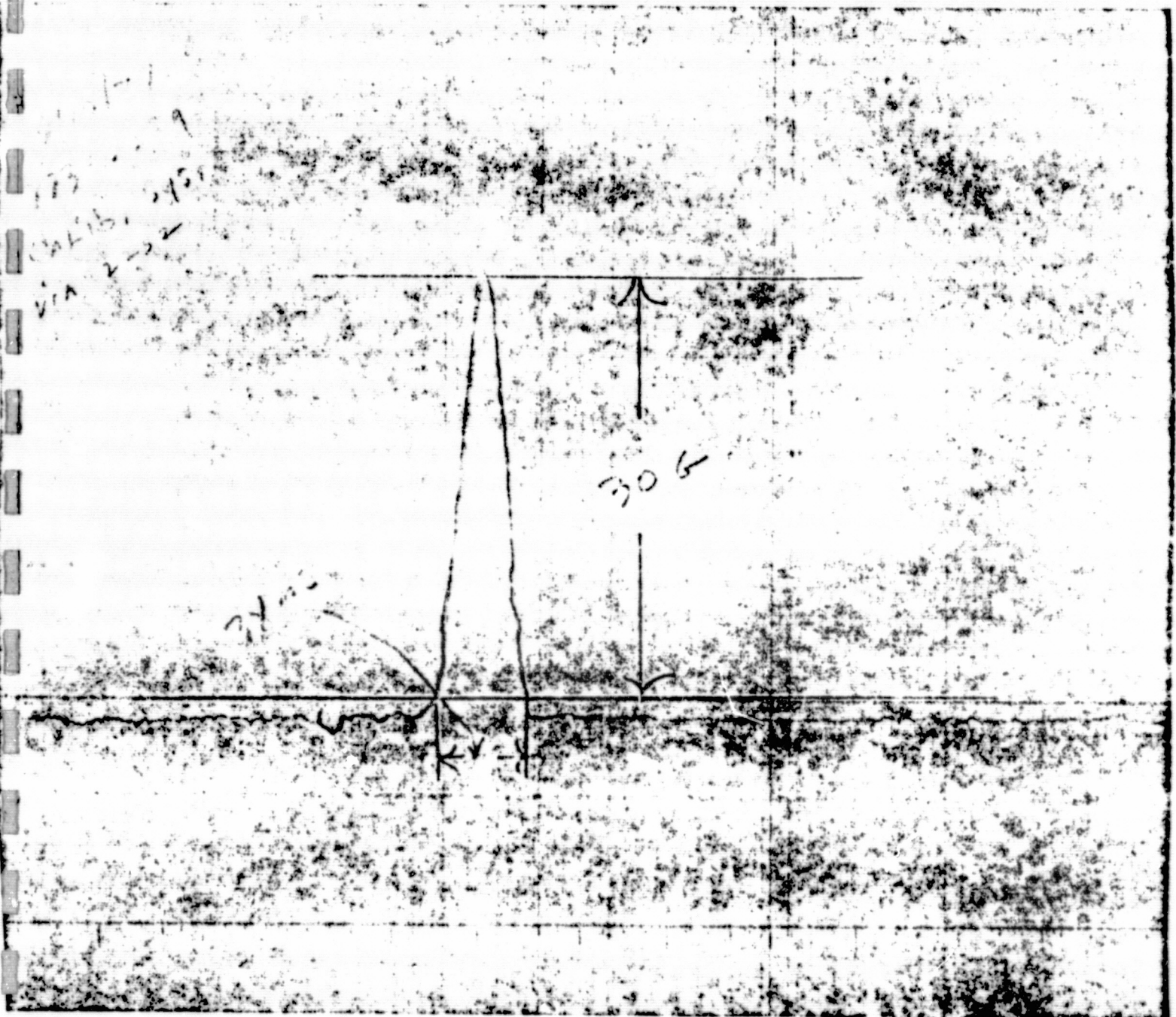
COMMENTS:

Berry F. Moore
Berry F. Moore, Test Engineer



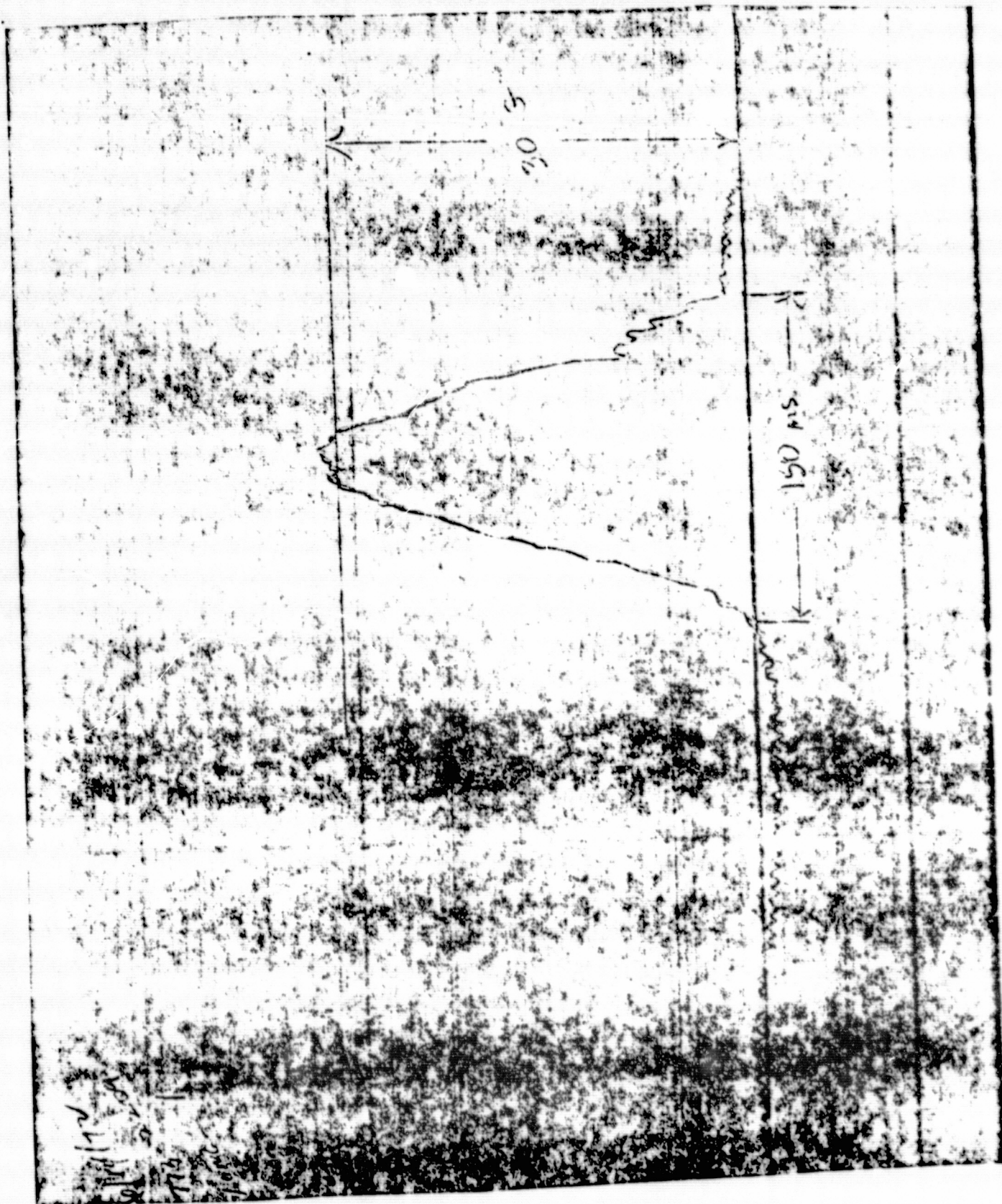
APPROVED ENGINEERING TEST LABORATORIES

ORIGINAL PAGE IS
OF POOR QUALITY





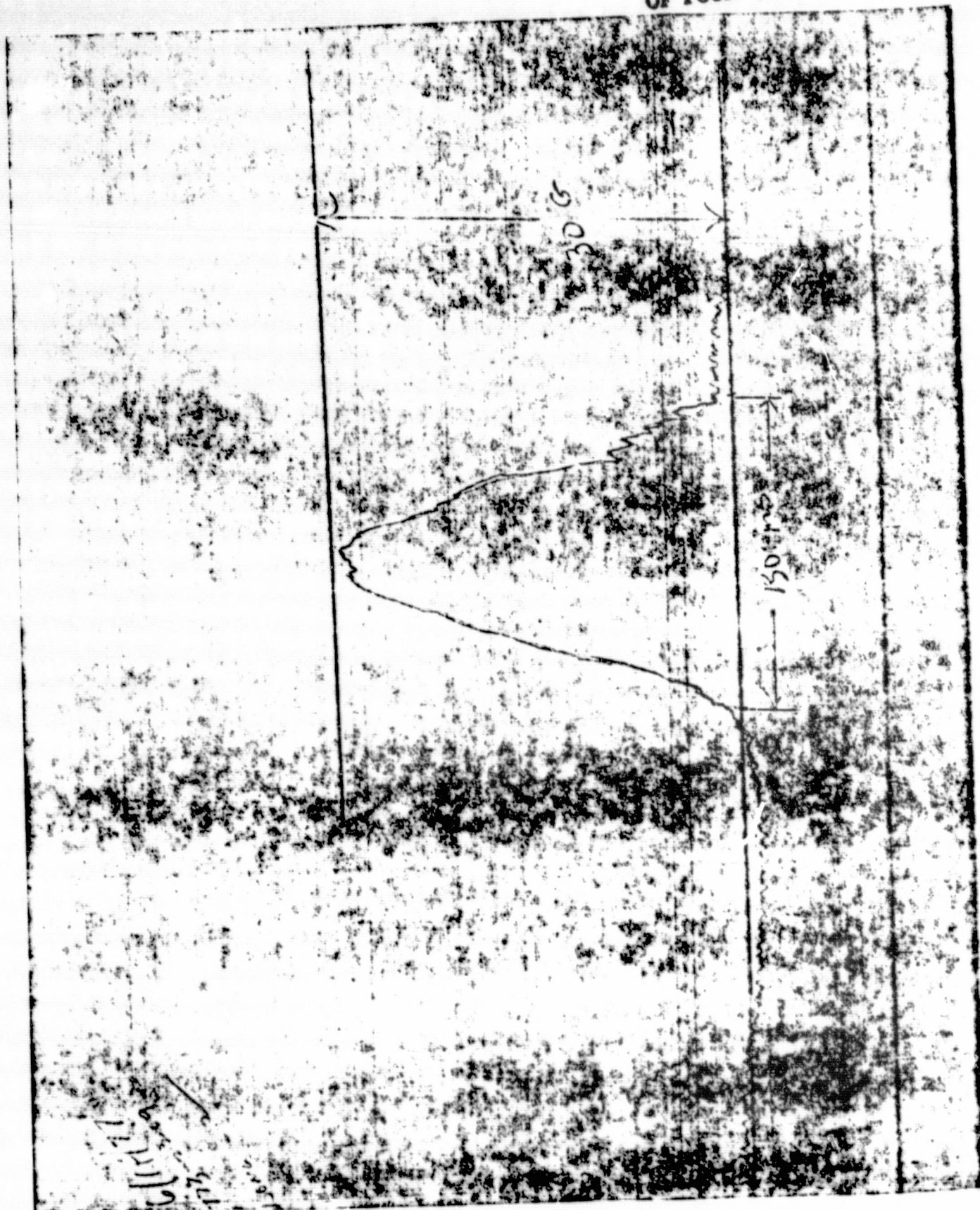
APPROVED ENGINEERING TEST LABORATORIES

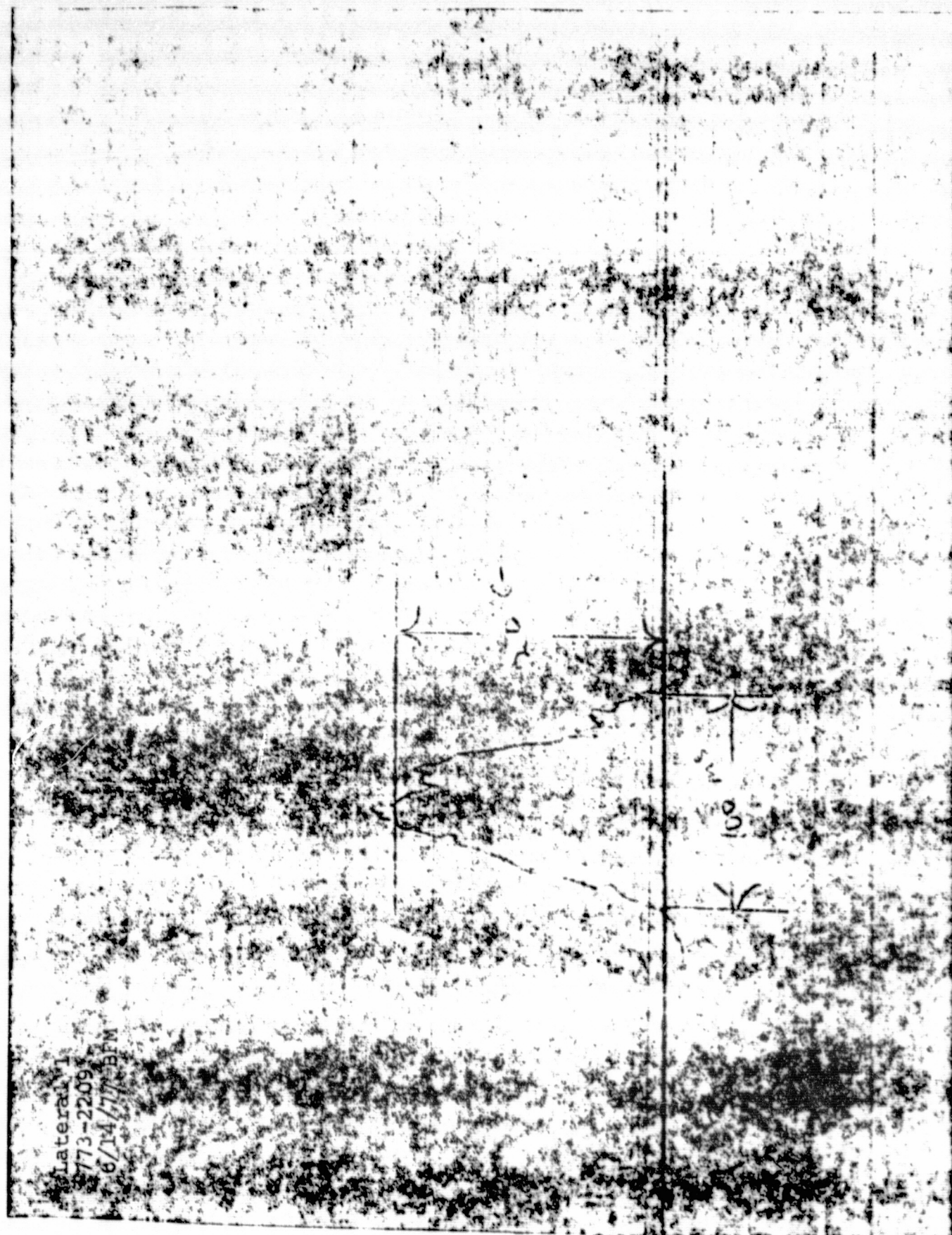




APPROVED ENGINEERING TEST LABORATORIES

ORIGINAL PAGE IS
OF POOR QUALITY



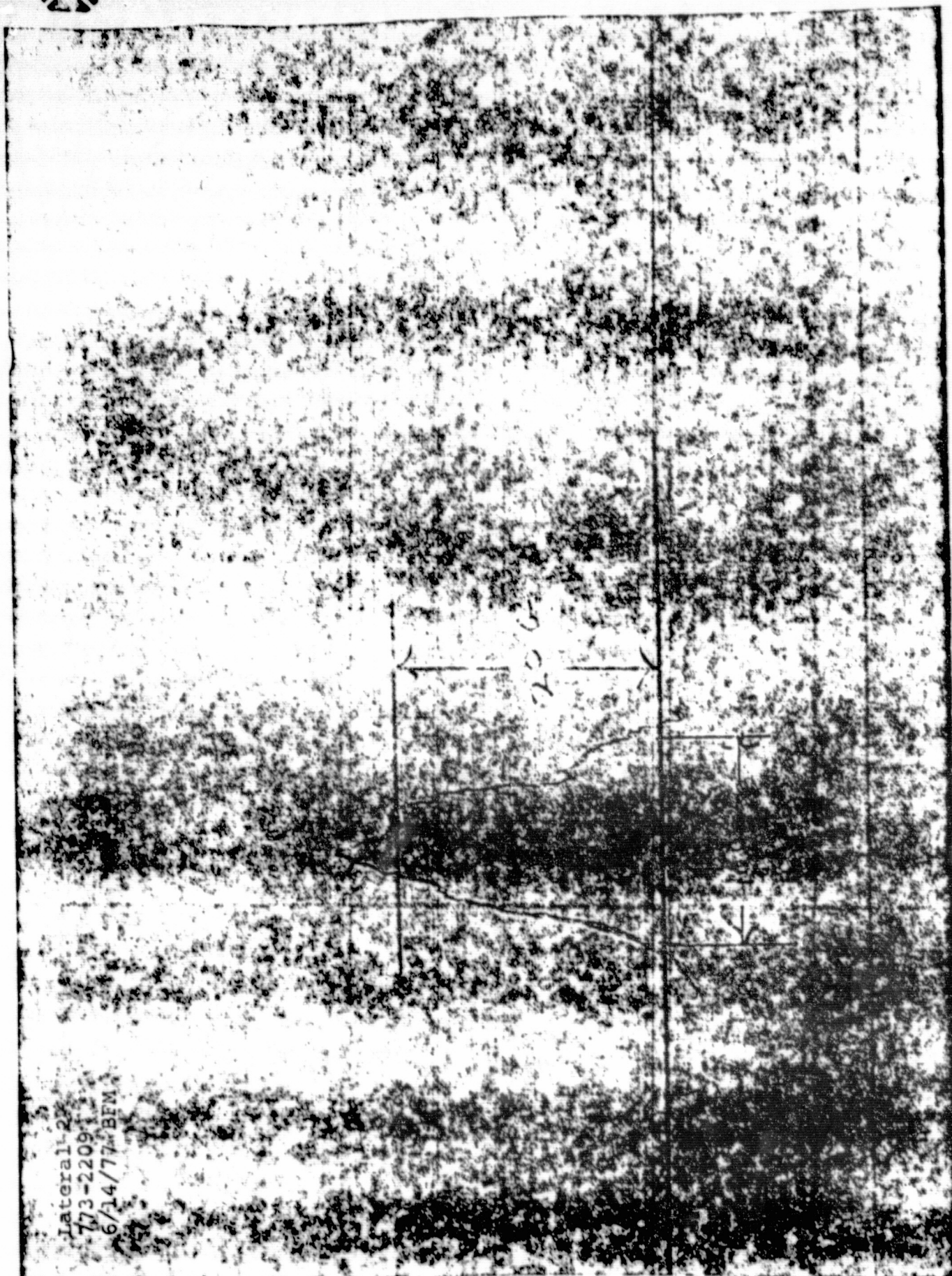


lateral
773-2209
6/14/77 BFM



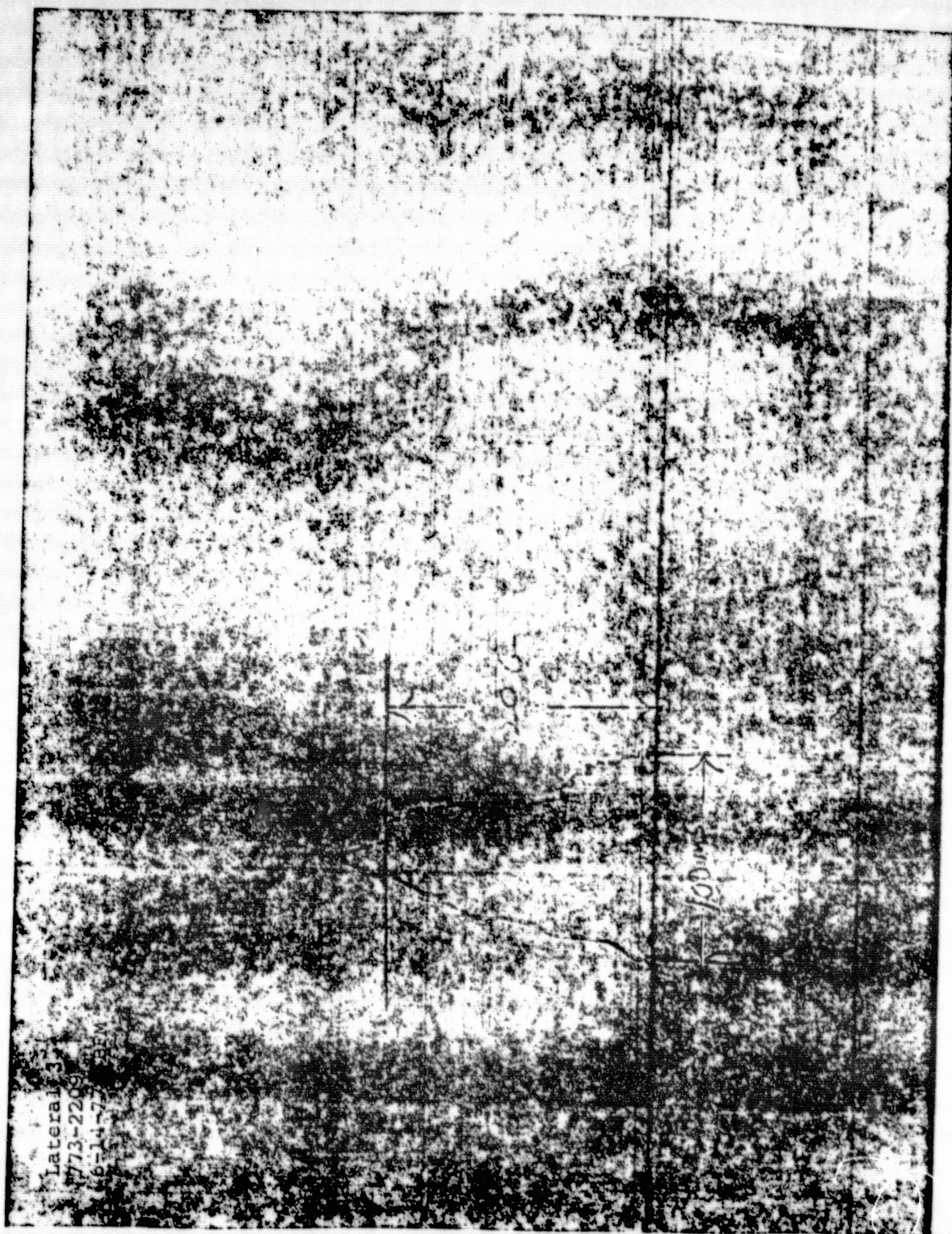
APPROVED ENGINEERING TEST LABORATORILS

ORIGINAL PAGE IS
OF POOR QUALITY





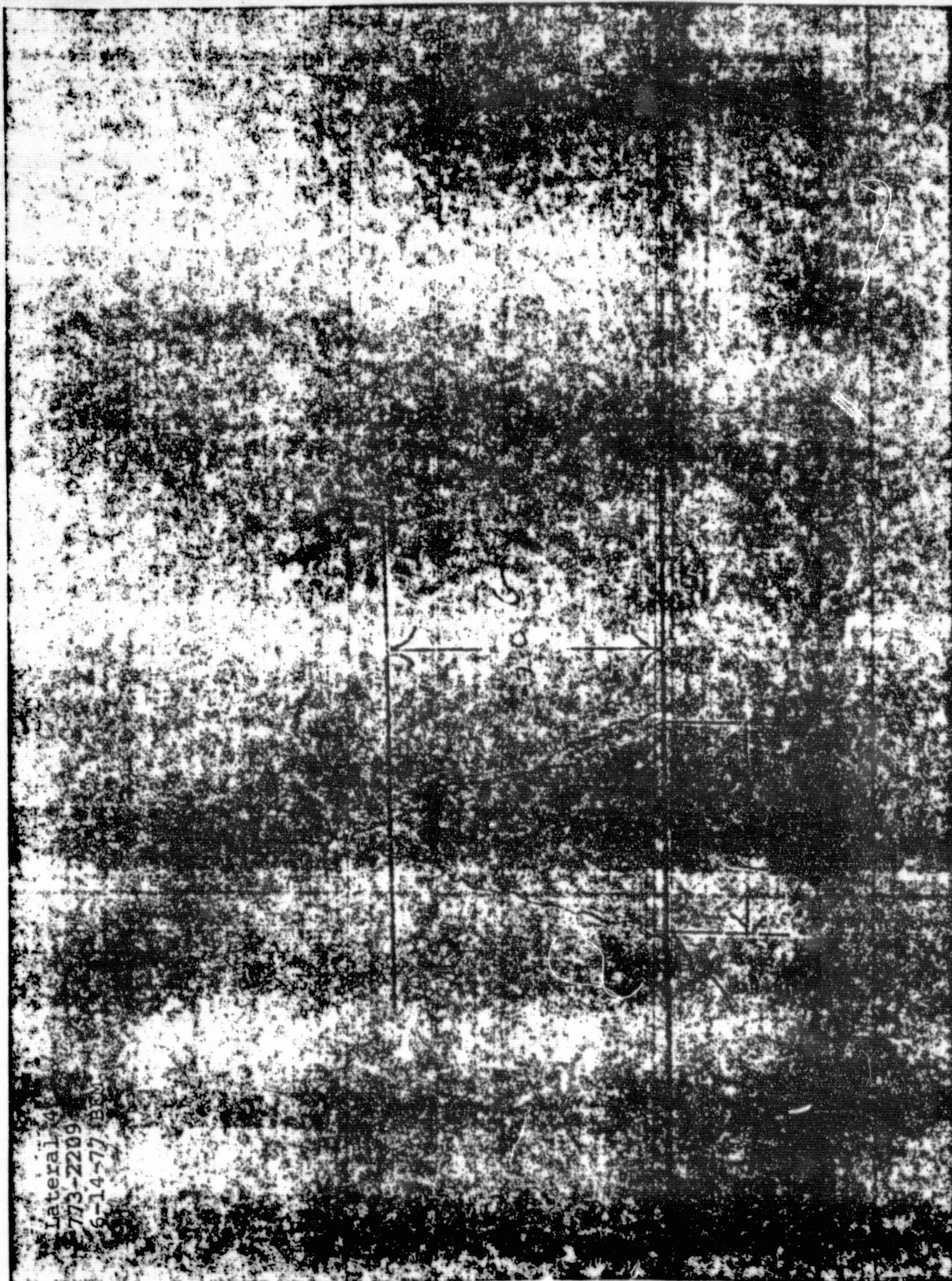
APPROVED ENGINEERING TEST LABORATORIES



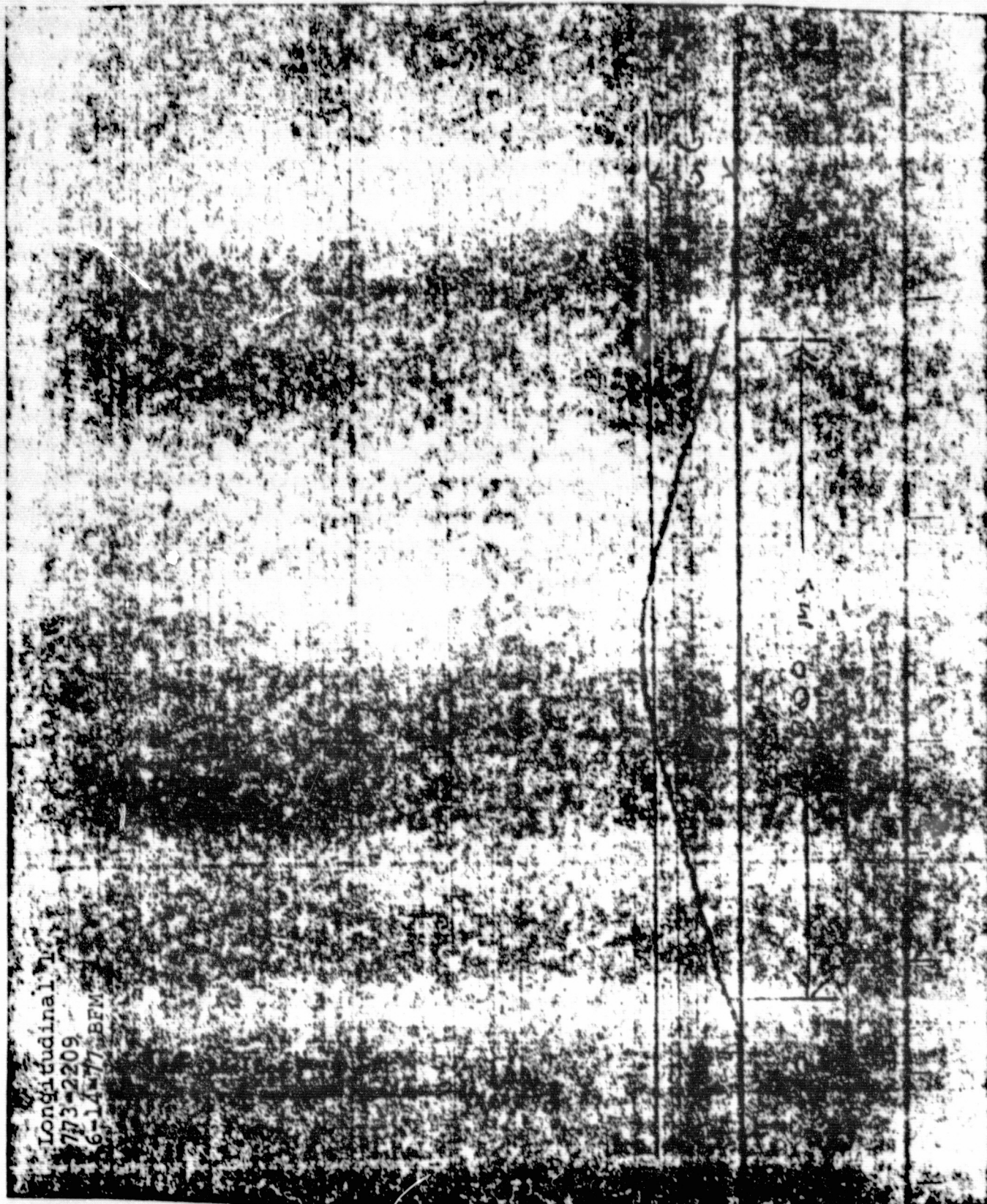


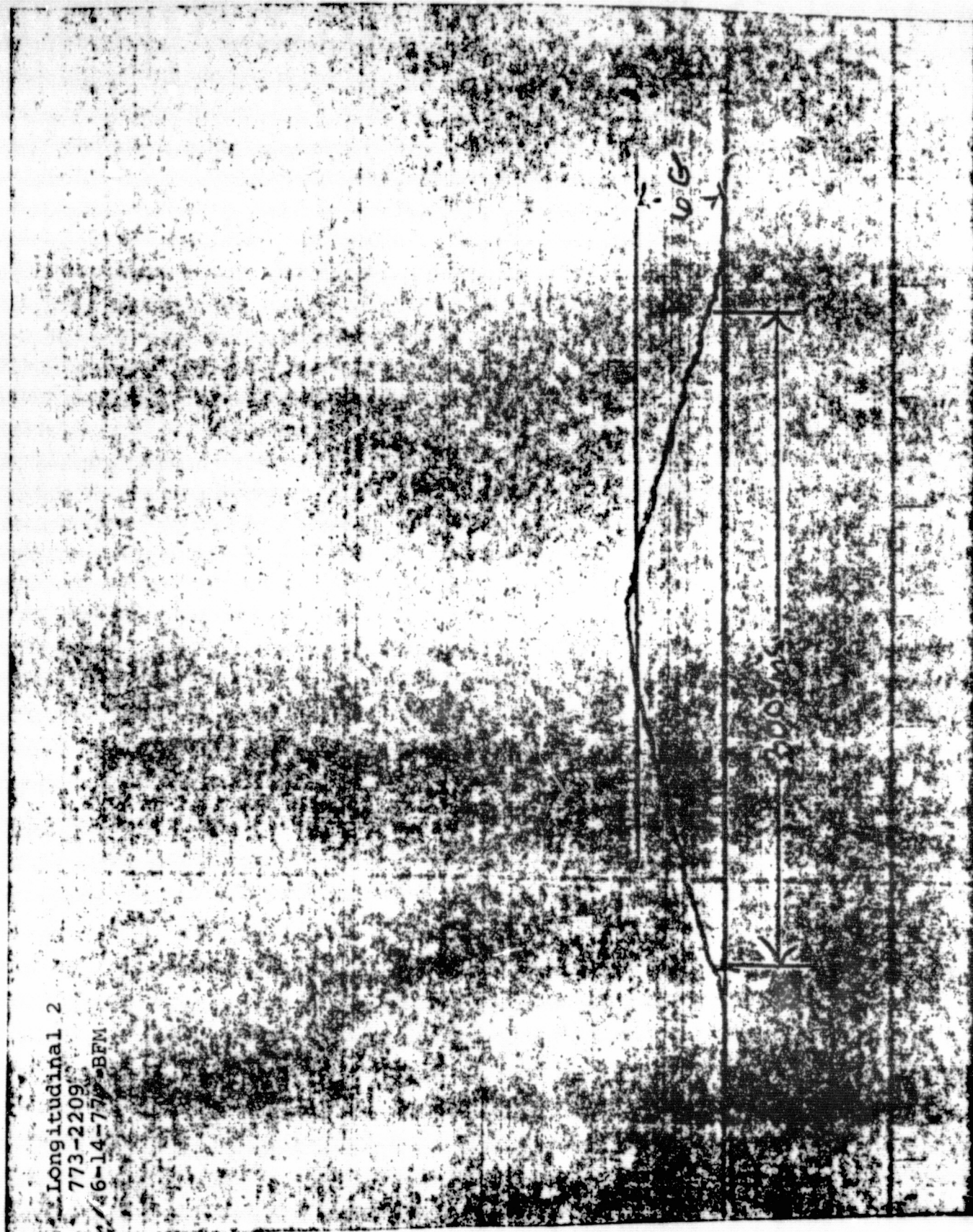
APPROVED ENGINEERING TEST LABORATORIES

ORIGINAL PAGE IS
OF POOR QUALITY

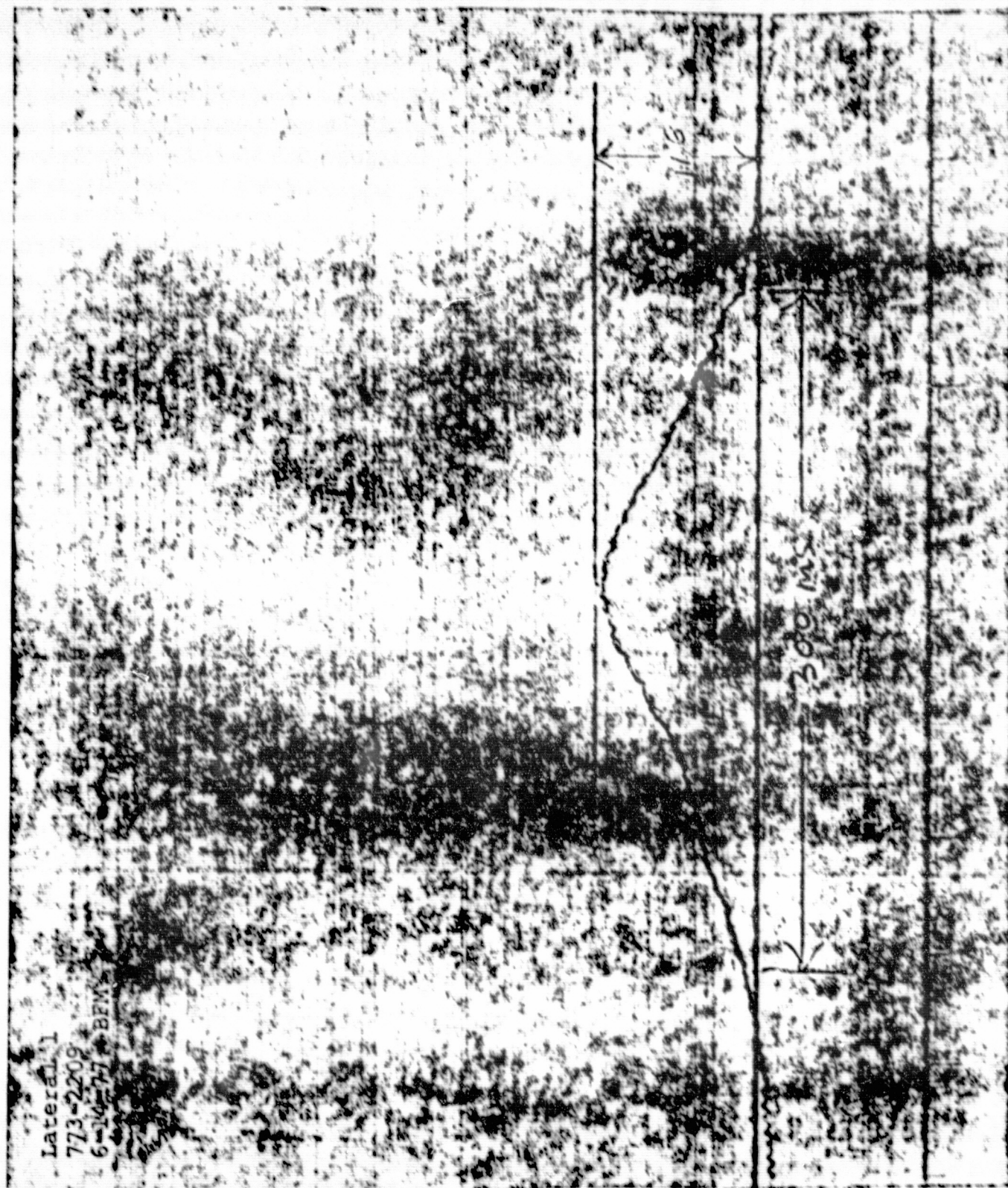


Lateral
773-2209
6-14-77 B30





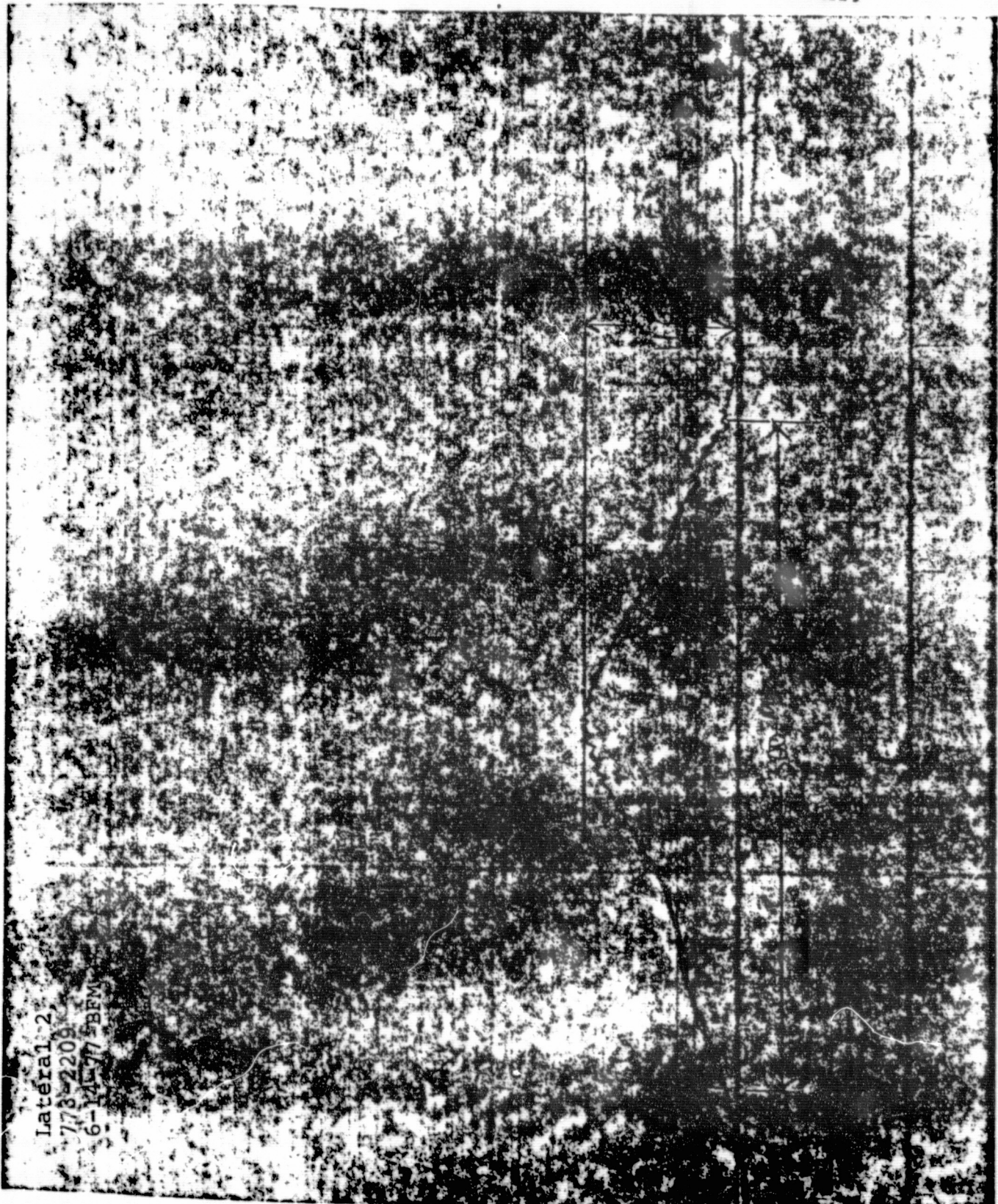
Longitudinal 2
773-2209
6-14-77-BFM



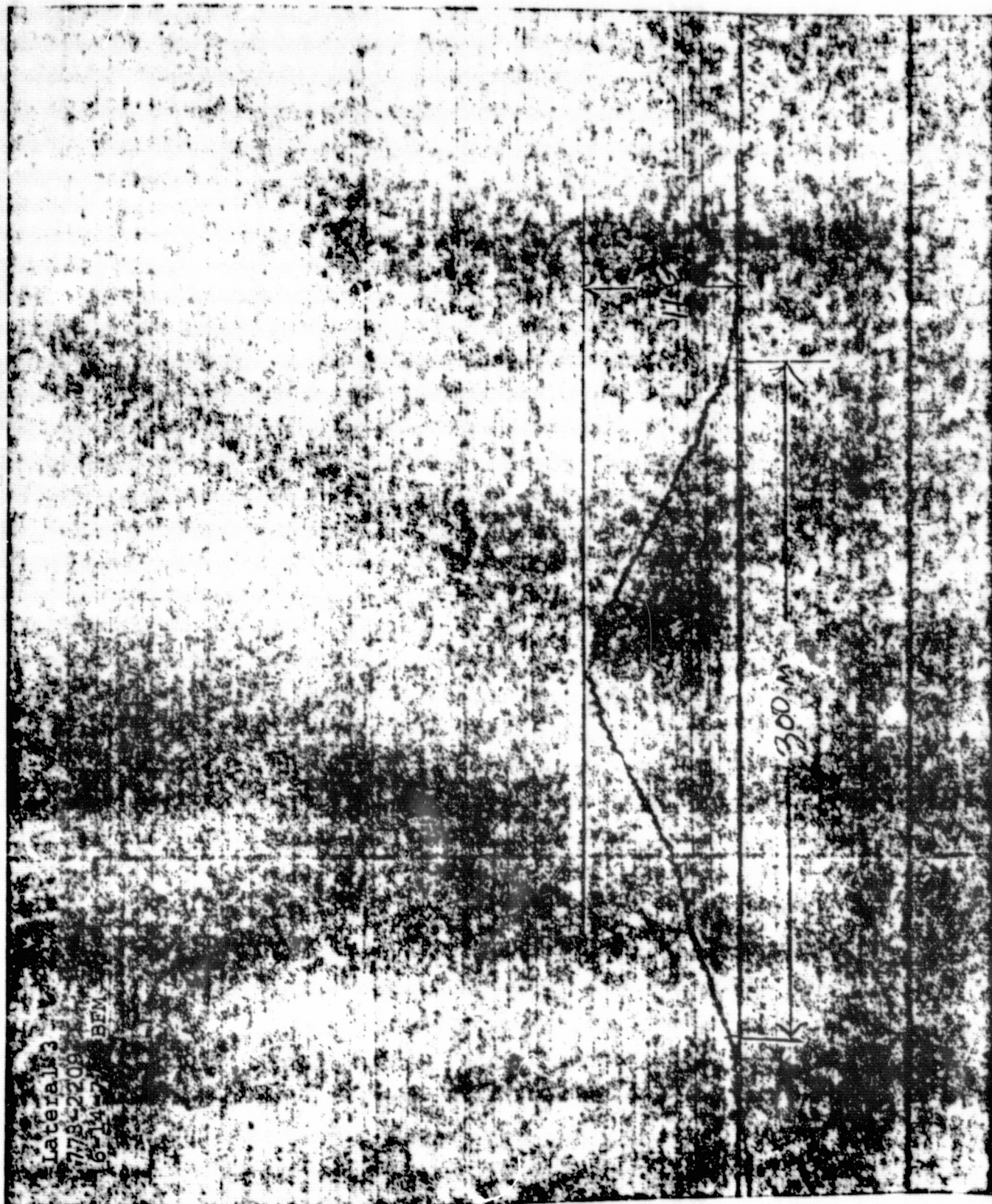


APPROVED ENGINEERING TEST LABORATORIES

ORIGINAL PAGE IS
OF POOR QUALITY



lateral 2
773-2209
6-14-77 BFM



A P P E N D I X 1

Description of Test Apparatus

The instrumentation used in the performance of these tests is periodically calibrated and standardized within manufacturer's rated accuracies. The calibration procedures and practices are in accordance with MIL-C-45662A. Certification of calibration is on file subject to inspection by request.



APPROVED ENGINEERING TEST LABORATORIES

EQUIPMENT LIST

<u>Description</u>	<u>Apparatus</u>	<u>Calibration</u>
<u>SINE VIBRATION</u>	*Mentor Stop Watch, Model Special AETL Control No. D-4124-F	12 months Due 10-21-77
	Brueel & Kjaer Automatic Exciter Control, Model 1018, AETL Control No. D-4024-F	6 months Due 6-22-77
	Endevco Accelerometer, Model 2242, AETL Control No. D-4091-F	12 months Due 1-16-78
	*Ling Vibration Exciter, Model A300	Not Required
	*Ling Vibration Amplifier, Model PP20/20	Not Required
	*Ling Accel. Normalizing Amplifier, Model ANA-100, AETL Control No. D-4003-F	3 months Due 8-7-77
<u>RANDOM VIBRATION</u>	*Snap-On Torque Wrench, Model 0-75"lbs., AETL Control No. G-4022-F	12 months Due 11-2-77
	Ling ASDE-80, Equalizer-Analyzer, AETL Control No. D-4085-F	3 months Due 7-14-77
	Endevco Accelerometer, Model 2242, AETL Control No. D-4091-F	12 months Due 1-16-78
	Ballantine RMS Meter, Model 320 AETL Control No. D-4129-F	6 months Due 10-20-77
	Esterline Angus X-Y Recorder, Model 575, AETL Control No. D-4080-F	6 months Due 8-7-77
	Spectral Dynamics Real Time Analyzer, Model SD330, AETL Control No. D-4125-F	6 months Due 8-11-77
* Equipment used in both tests.		



APPROVED ENGINEERING TEST LABORATORIES

EQUIPMENT LIST

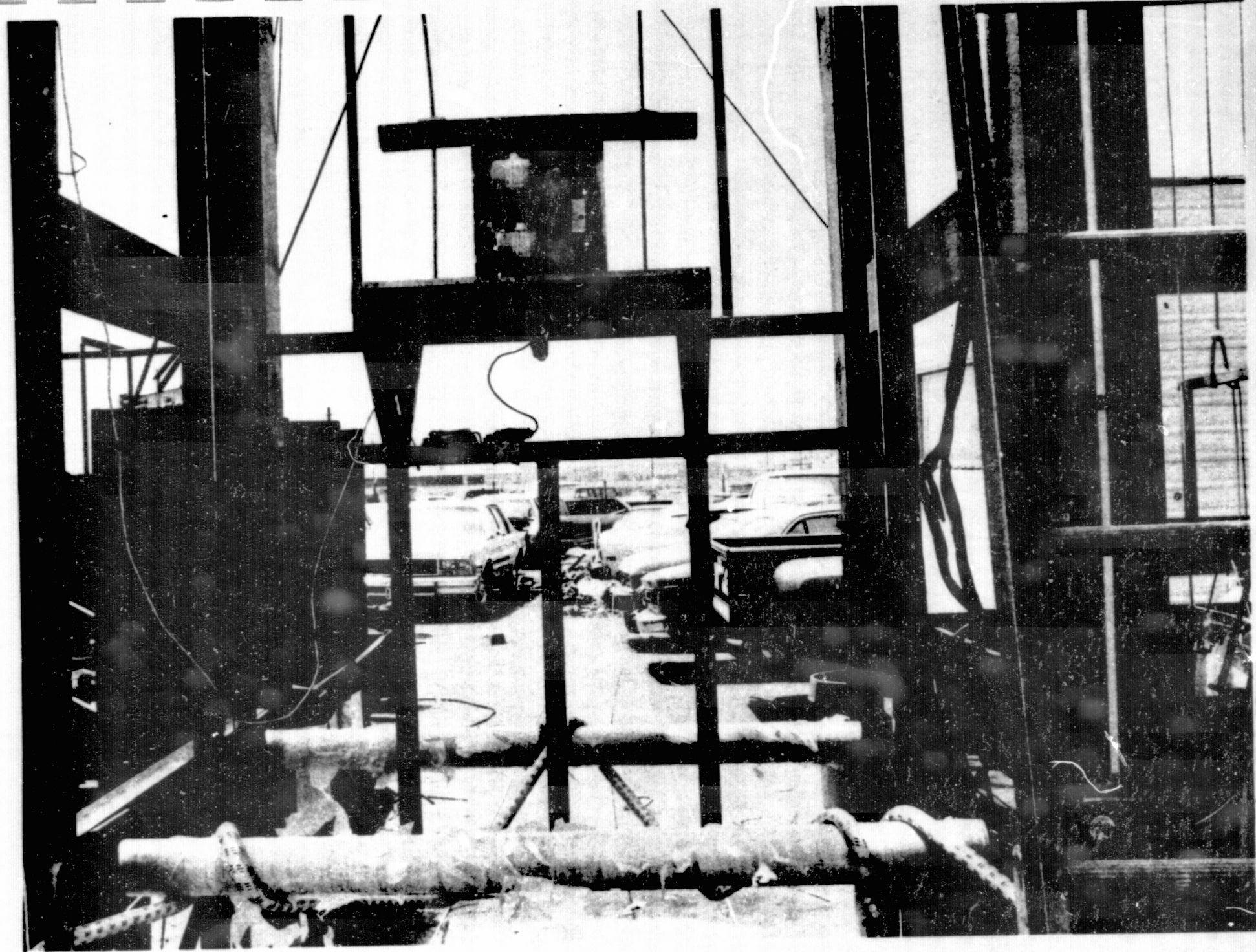
<u>Description</u>	<u>Apparatus</u>	<u>Calibration</u>
<u>SHOCK SPECTRA</u>	Bruel & Kjaer Instruments Spectrum Shaker, Model 123, AETL Control No. D-4074-F	Not Required
	Spectral Dynamics Spectrum Analyzer, Model SD320, AETL Control No. D-4073-F	6 months Due 7-19-77
	Endevco Accelerometer, Model 2225, AETL Control No. D-4257-F	12 months Due 3-14-78
	Esterline Angus X-Y Recorder, Model 575, AETL Control No. D-4126-F	6 months Due 7-22-77
	Vibration Exciter, Ling Model A300	Not Required
	Vibration Amplifier, Ling Model PP20/20	Not Required
	Ling Accel. Normalizing Amplifier, Model ANA-100, AETL Control No. D-4003-F	3 months Due 8-7-77
<u>WATER LANDING & PARACHUTE DEPLOYMENT SHOCK</u>	Snap-on Torque Wrench, Model 0-75"lbs., AETL Control No. G-4022-F	12 months Due 11-2-77
	Statham A5A-100-350 Accelerometer, 0 to 100 g, S/N 1475, AETL Control No. D-904-S	
	CEC 5-124 Oscillograph Recorder, AETL Control No. 2523	Calibrated as a System Prior to Test
	CEC Carrier Amplifier, Type 1-118, AETL Control No. 2440	
	Tektronix 180-S1 Time Mark Generator, AETL Control No. E-4264-F	



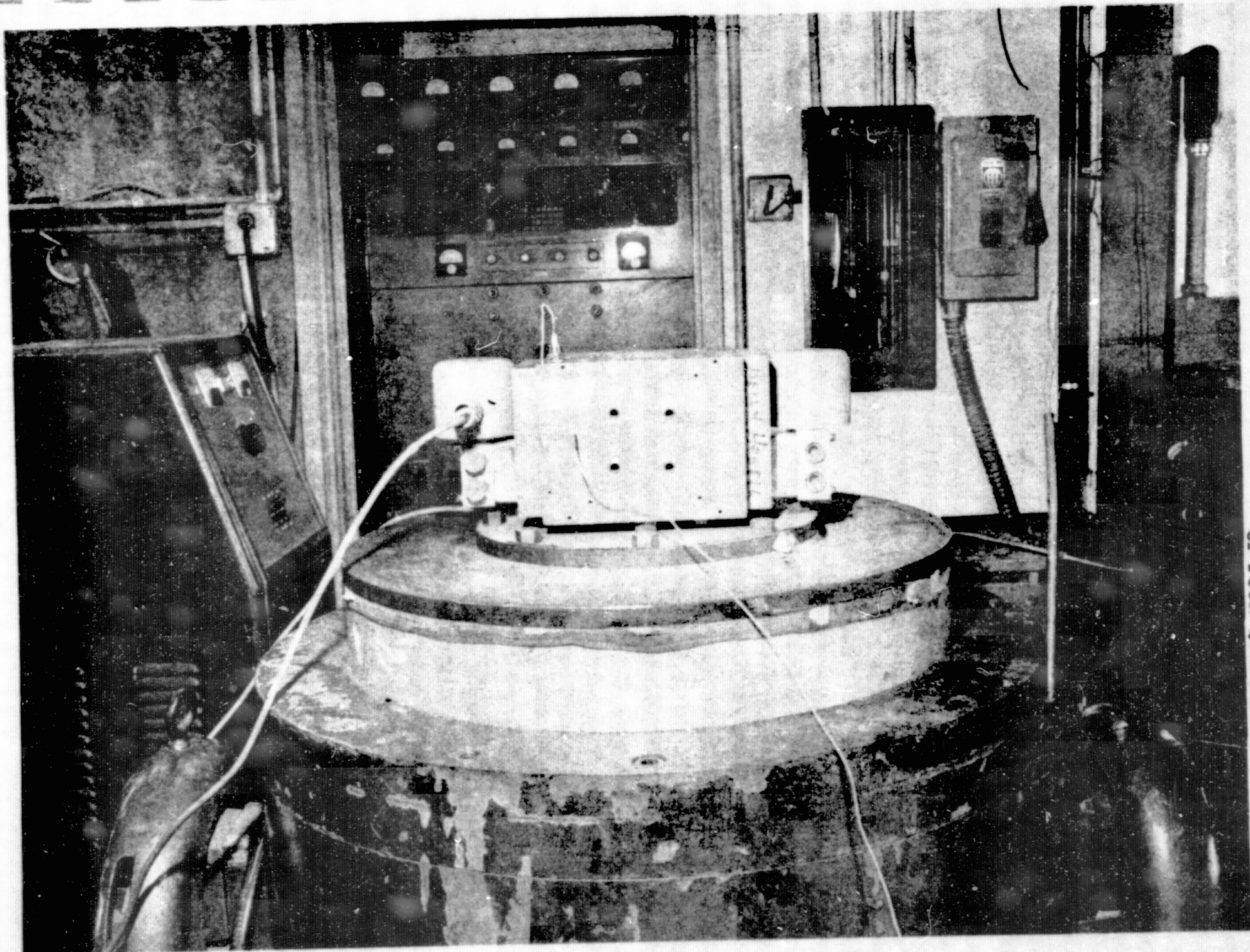
APPROVED ENGINEERING TEST LABORATORIES

A P P E N D I X 2

Photographs



ORIGINAL PAGE IS
OF POOR QUALITY



ORIGINAL PAGE IS
OF POOR QUALITY



APPROVED ENGINEERING TEST LABORATORIES

SERVICE FOR:

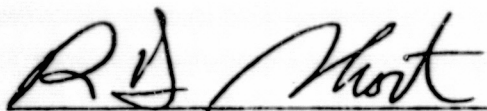
Teledyne McCormick-Selph
3601 Union Road
Hollister, California 95023

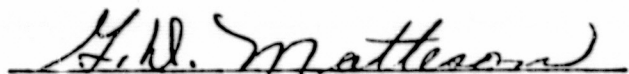
PURCHASE ORDER NUMBER:

93929RR

I hereby certify that the preceding report is true and correct
to the best of my knowledge.

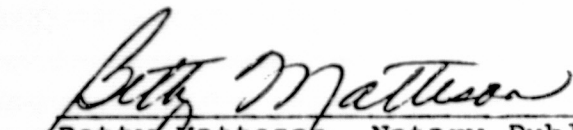
APPROVED ENGINEERING TEST LABORATORIES


R. D. Short, Division Manager


G. D. Matteson, Project Engineer

Subscribed and sworn to before me this 23rd day of June 1977.

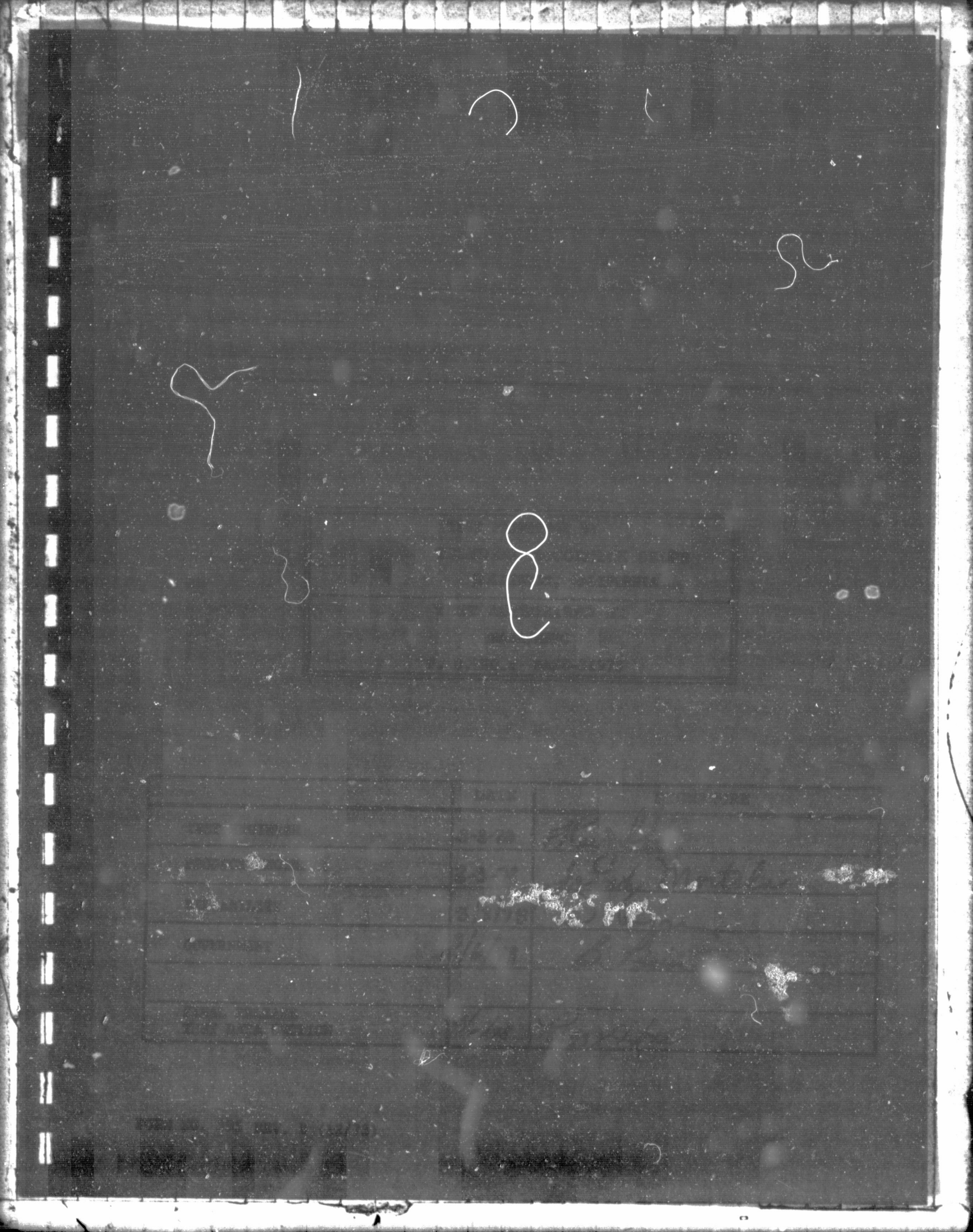



Betty Matteson, Notary Public in and for the County of Orange,
State of California. My commission expires October 29, 1977.


R. J. McKelligott,
Quality Assurance Manager



mne



TELETYPE MCCORMICK SELPH

JOB NUMBER 4918-78 W.O. 246

REPORT NUMBER 4918-246

DATE 6 FEBRUARY 1978

PURPOSE OF TEST

LOT ACCEPTANCE ☒

DEVELOPMENT ☐

PREPROD/ PERIODIC / QUAL ☐

ENG. EVALUATION ☐

PRELOAD ☐

FAILURE ANALYSIS ☐

PERFORMANCE INSTRUCTIONS

PERFORM LOT ACCEPTANCE TESTING IN ACCORDANCE WITH TMC/S TEST
PROCEDURE ATP 816780 REV. B.

TEST SUMMARY SHEET

JOB NUMBER 4918-78-239

REPORT NUMBER 4918-239

CUSTOMER PART NO.: 10A00465-103 & -113 RI

TMc/S PART NUMBER 816780-3 & -7 REV. E

CUSTOMER SPECIFICATION 10A00455 E

TMc/S PROCEDURE ATP 816780 REV. B

DATE TEST COMPLETED 18 JANUARY 1978

TYPE OF TEST	② REFERENCE PARAGRAPH	MEASURED VALUES		NUMBER OF UNITS		REMARKS AND/OR UNTOWARD INCIDENTS
		MINIMUM	MAXIMUM	TESTED	ACCEPTED	
EXAMINATION	5.1	N/A	N/A	16	16	NONE
X-RAY	5.2	N/A	N/A	16	16	NONE
N-RAY	5.3	N/A	N/A	16	16	NONE
VIBRATION	5.4	20 Hz 8.7 grms -----	2000 Hz 11.4 grms 1 Min./axis	16	16	NONE
LEAK	5.5	61Kft 2 Minutes	----- -----	16	16	NONE
TEMP. ELECT. CYCLING	5.6	24 VDC +20°F	32 VDC +165°F	16	9	Unit S/N's 0005, 0009, 0011, 0013, 0017 & 0020 - 90 degree rotation time exceeded 250 milliseconds. Unit Serial Number 0013 actuation current exceeded 3 amperes. Unit S/N 0019 - No voltage output trace. Referer TMc/S Discrepancy Report No. 37621 on next page. NOTE: The above seven (7) test specimens were reworked and subjected again to the complete Lot Acceptance Tests require - see details in Appendix B of this report.
AMBIENT ELECTRICAL CHECK-OUT	5.7	500 VDC 100 MEGOHMS	----- -----	10	10	
ACCEPTANCE TEST OF P/N 817187 EXPLOSIVE LEAD ASSEMBLY, A COMPONENT OF SAFE AND ARM 816780 - TEST RESULTS ARE INCLUDED IN APPENDIX A.						

Reference paragraphs ① Customer Specification ② TMc/S Procedure

ORIGINAL PAGE IS
OF POOR QUALITY

McCORMICK-SELPH
ATELEDYNE COMPANY

DISCREPANCY REPORT

No. J

VENDOR OR WORK AREA TEST DEPARTMENT NO 32

DWG. NO 816780-3 REV. H

DATE 16 JAN. 1978

P.O./W.O. NO.

/245

JOB NO. 4918

TM's ATP 816780 3
REFER TO

ITEM SAFETY ARMING DEVICE

LOT SIZE 16 EA

SAMPLE SIZE 16 EA

DESCRIPTION OF DEFECTS

INSPECTION TIME

SAMPLE

100%

7 ea -

ITEM	DWG. &/OR SPEC.	ACTUAL	AQL	QTY.	100%
1	ATP 816780 REV. B FIG. 3	NO VOLTAGE TRACE UNIT S/N 0019	-0-	1 EA	1 EA
2	ATP 816780 REV. B PARAGRAPH 5.6.6(A) AT PLUS 165°F	UNITS S/N 0005, 0009, 0011, 0013, 0017 AND 0020 DAMAGED TIME FOR 90 DEGREE ROTATION EXCEEDED 250 MILLISECOND @ 24 VDC INPUT	-0-	6 EA	6 EA
3	ATP 816780 REV. B PARAGRAPH 5.6.6(B)	UNIT S/N 0013 ACTUATION CURRENT EXCEEDED 3 AMPERES (DOA defect)	-0-	1 EA	1 EA

Items 1, 2+3 were tested per ATP 816780 and are acceptable
2-27-78

PLANNER

PURCHASING

INSPECTOR

J. FOSHEE

☐ M.R.B.

DISPOSITION

☒ P.R.B.

REWORK AND USE AS IS

UAI

RTV

SCRAP

2 - Retest units at 24 Volts. Increase voltage in .5 volts steps until units operate properly. This test is for info only.

2.3 Disassemble and evaluate units per repair & rework procedure # 0582.

-3 Rework per procedure # 0583 and retest.

QUALITY ASSURANCE

ENGINEER

CUSTOMER

GOVERNMENT

CORRECTIVE ACTION TAKEN TO PREVENT RECURRENCE OF THE ABOVE DISCREPANCIES (TO BE COMPLETED BY THE VENDOR OR PRODUCTION SUPERVISOR).

Item 1 - Cut length of wire to be increased by 3/8 - 1/2" to alleviate strain on wire during assay.

Items 2 & 3 - Implemented additional functional checks as part of receiving inspection. In addition fine tuning @ high & low temperatures & voltage will be performed as part of assembly.

EFFECTIVITY (DATE OR SERIAL NO.)

all future build.

SEE OTHER SIDE IF REQUIRED

SIGNATURE

PAGE 3 OF 4



TELEDYNE McCORMICK SELPH

Hollister, Calif. • 95023

TEST REPORT

JOB NUMBER 4918-78 W.O. 246

REPORT NUMBER 4918-246

DATE 3 FEBRUARY 1978

EQUIPMENT LIST

ITEM NO.	NAME	MANUFACTURER	MODEL	ACCURACY	CALIBRATION DUE DATE
1	TEMPERATURE CHAMBER	MISSIMERS	FT-4	N/A	N/A
2	TEMPERATURE RECORDER	KAYE INST.	6100	$\pm 1^{\circ}\text{F}$	5/7/78
3	D.C. POWER SUPPLY	PERKINS	TVCR-040-5	N/A	N/A
4	FUNCTION MONITOR	DOUGLAS	SA 1077-1	$\pm 1\%$	2/28/78
5	OSCILLOGRAPH	HONEYWELL	906	N/A	N/A
6	CABLE	DOUGLAS	SA 1077-3	N/A	N/A
7	TIME MARKER	TMc/S	N/A	$\pm .01\%$	3/28/78
8	PRESSURE CHAMBER	TMc/S	N/A	N/A	N/A
9	VACUUM GAUGE	MANOMETER	30"	N/A	N/A
10	VACUUM PUMP	CENCO	MEGAVAC	N/A	N/A
11	MANOMETER	MERIAM INST.	10AA25WM	N/A	N/A
12	STOP WATCH	KODAK	60 MIN.	$\pm 1\%$ RDG.	5/14/78
13	TEMPERATURE CHAMBER	MISSIMERS	FT-8	USE WITH CALIB. INST.	
14	OHMMETER	ALINCO	101-5F	$\pm 1\%$ RDG.	5/14/78
15	MEGOHMMETER	FREED	1620	$\pm 5\%$ FS	5/7/78

PAGE 5 OF 59 PAGES

TEST ORDER 4918-246
DATE: 13 JANUARY 1978
SUCCEEDING TEST Temp. Elect.
Cycling

TIME DURATION 2.0 MIN.
TIME DURATION 2.0 MIN.

AMBIENT TEMP.

WITNESSED BY: B. Purinton

TESTED BY: B. Zuniga

TMc/S PART NUMBER - 816780-7 REV. E (SERIAL NUMBERS 0007 & 0015 - INERT PARTS)
816780-3 REV. E (SERIAL NUMBERS 0005, 0006, 0008, 0009, 0010, 0011,
0012, 0013, 0014, 0016, 0017, 0018, 0019, & 0020)

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOS NUMBER 4918-78

W. O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.

UNIT NO. -----

SERIAL NO. 0007

TEST TEMP. +165

TMc/S PART NUMBER 816780-7 REV. E (INERT PART)

[illegible]

B. ZUNIGA

TECHNICIAN

B. Purinton

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

XX ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOS NUMBER 4918-78

W. O. NUMBER 246

TIME/S	PART NAME	SAFETY & ARMING DEVICE
0000	ARMED	ARMED
0001	ARMED	ARMED
0002	ARMED	ARMED
0003	ARMED	ARMED
0004	ARMED	ARMED
0005	ARMED	ARMED
0006	ARMED	ARMED
0007	ARMED	ARMED
0008	ARMED	ARMED
0009	ARMED	ARMED
0010	ARMED	ARMED
0011	ARMED	ARMED
0012	ARMED	ARMED
0013	ARMED	ARMED
0014	ARMED	ARMED
0015	ARMED	ARMED
0016	ARMED	ARMED
0017	ARMED	ARMED
0018	ARMED	ARMED
0019	ARMED	ARMED
0020	ARMED	ARMED
0021	ARMED	ARMED
0022	ARMED	ARMED
0023	ARMED	ARMED
0024	ARMED	ARMED
0025	ARMED	ARMED
0026	ARMED	ARMED
0027	ARMED	ARMED
0028	ARMED	ARMED
0029	ARMED	ARMED
0030	ARMED	ARMED
0031	ARMED	ARMED
0032	ARMED	ARMED
0033	ARMED	ARMED
0034	ARMED	ARMED
0035	ARMED	ARMED
0036	ARMED	ARMED
0037	ARMED	ARMED
0038	ARMED	ARMED
0039	ARMED	ARMED
0040	ARMED	ARMED
0041	ARMED	ARMED
0042	ARMED	ARMED
0043	ARMED	ARMED
0044	ARMED	ARMED
0045	ARMED	ARMED
0046	ARMED	ARMED
0047	ARMED	ARMED
0048	ARMED	ARMED
0049	ARMED	ARMED
0050	ARMED	ARMED
0051	ARMED	ARMED
0052	ARMED	ARMED
0053	ARMED	ARMED
0054	ARMED	ARMED
0055	ARMED	ARMED
0056	ARMED	ARMED
0057	ARMED	ARMED
0058	ARMED	ARMED
0059	ARMED	ARMED
0060	ARMED	ARMED
0061	ARMED	ARMED
0062	ARMED	ARMED
0063	ARMED	ARMED
0064	ARMED	ARMED
0065	ARMED	ARMED
0066	ARMED	ARMED
0067	ARMED	ARMED
0068	ARMED	ARMED
0069	ARMED	ARMED
0070	ARMED	ARMED
0071	ARMED	ARMED
0072	ARMED	ARMED
0073	ARMED	ARMED
0074	ARMED	ARMED
0075	ARMED	ARMED
0076	ARMED	ARMED
0077	ARMED	ARMED
0078	ARMED	ARMED
0079	ARMED	ARMED
0080	ARMED	ARMED
0081	ARMED	ARMED
0082	ARMED	ARMED
0083	ARMED	ARMED
0084	ARMED	ARMED
0085	ARMED	ARMED
0086	ARMED	ARMED
0087	ARMED	ARMED
0088	ARMED	ARMED
0089	ARMED	ARMED
0090	ARMED	ARMED
0091	ARMED	ARMED
0092	ARMED	ARMED
0093	ARMED	ARMED
0094	ARMED	ARMED
0095	ARMED	ARMED
0096	ARMED	ARMED
0097	ARMED	ARMED
0098	ARMED	ARMED
0099	ARMED	ARMED

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.

UNIT NO. -----

SERIAL NO. 0008

TEST TEMP. +165

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA

TECHNICIAN

B. Purinton

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

XX ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S



TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

DATE 16 JANUARY 1978

W. O. NUMBER 246

TMc/S DWG. NUMBER 816780 REV. E

TMC/S PROCEDURE ATP 816780 REV. B

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.

SERIAL NO. 0009

TEST TEMP. +165

TMC/S PART NUMBER 816780-3 REV. E

B. ZUNIGA

TECHNICIAN

B. Purinton

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

XX DISCREPANCY/S NOTED OF UNIT/S * ROTOR FAILED TO ROTATE



TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W.O. NUMBER 246

7Mc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

TEST EQUIPMENT ITEM NUMBERS 1-7
REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.

UNIT NO. -----

SERIAL NO. 0010

TEST TEMP. +165

TMc/S PART NUMBER 816780-3 REV. E

B. ZUNIGA

TECHNICIAN

B. Purinton

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

XX ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
C DISCREPANCY/S NOTED OF UNIT/S_____



TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

DATE 16 JANUARY 1978

W. O. NUMBER 246

TMc/S DWG. NUMBER 816780 REV. E

TMC/S PROCEDURE ATP 816780 REV. B

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.

TEST TEMP. +165

TMc/S PART NUMBER 816780-3 REV. E

B. ZUNIGA

TECHNICIAN

B. Purinton

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

3 DISCREPANCY/S NOTED OF UNIT/S * ROTOR FAILED TO ROTATE UPON 1ST ACTUATION, BUT ROTATED UPON SECOND, THIRD & FOURTH ACTUATION. ** ROTOR FAILED TO ROTATE

TELEDYNE McCORMICK SELPH

HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET

FOR

OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.

UNIT NO. _____

SERIAL NO. 0012

TEST TEMP. +165

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA

TECHNICIAN

B. Purinton

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.



TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

DATE 16 JANUARY 1978

W. O. NUMBER 246

TMC/S DWG. NUMBER 816780 REV. E

TMC/S PROCEDURE ATP 816780 REV. B

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.

TEST TEMP. +165

TMc/S PART NUMBER 816780-3 REV. E

B. Zuniga
TECHNICIAN

B. Purinton
WITNESS

VALUATION OF TEST RESULTS (CHECK ONE)

* 3 ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
* 3 DISCREPANCY/S NOTED OF UNIT/S__ * ROTOR ACTUATION TIME EXCEEDED 250 MILLISECONDS

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOS NUMBER 4918-78

W. O. NUMBER 246

TMC/S PART NAME SAFETY & ARMING DEVICE

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.

UNIT NO. -----

SERIAL NO. 0016

TEST TEMP. +165

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA

TECHNICIAN

B. Purinton

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

XX ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.



REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.

UNIT NO. -----

SERIAL NO. 0017

TEST TEMP. +165

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA

TECHNICIAN

B. Purinton

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

2 ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

X DISCREPANCY/S NOTED OF UNIT/S * ROTOR DID NOT ACTUATE

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMC/S PART NAME SAFETY & ARMING DEVICE

TMC / S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.

UNIT NO. _____

SERIAL NO. 0020

TEST TEMP. +165

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

2 ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
3 DISCREPANCY/S NOTED OF UNIT/S * ROTOR DID NOT ROTATE

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A60465

TMC/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1 THRU 7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

SHALL NOT EXCEED 3 AMPS

UNIT NO. ----

SERIAL NO. 0005

TEST TEMP. +75°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. Zuniga

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S **PROCEDURE** ATP 816780 REV. B

CUSTOMER SPECIFICATION _____
TEST EQUIPMENT ITEM NUMBERS _____ 1 THRU 7

TEST EQUIPMENT ITEM NUMBERS _____ THRU _____
REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

SHALL NOT EXCEED 3 AMPS

UNIT NO. ---

SERIAL NO. 0006

TEST TEMP. +75°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. Zuniga

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMc/S	PART NAME	<u>SAFETY & ARMING DEVICE</u>
1	SAFETY	SAFETY
2	ARMING	ARMING
3	DEVICE	DEVICE

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1 THRU 7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

SHALL NOT EXCEED 3 AMPS.

UNIT NO. ---

SERIAL NO. 0008

TEST TEMP. +75°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. Zuniga

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMc/S	PART NAME	<u>SAFETY & ARMING DEVICE</u>
1	SAFETY	SAFETY
2	ARMING	ARMING
3	DEVICE	DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1 THRU 7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

SHALL NOT EXCEED 3 AMPS

UNIT NO. - - - -

SERIAL NO. 0009

TEST TEMP. +75°F

TMC/S PART NUMBER 816780-3 REV. E

[illegible]

B. Zuniga
TECHNICIAN

B. PURINTON
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

* ☒ DISCREPANCY/S NOTED OF UNIT/S _____ * ROTOR DID NOT ROTATE



TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOS NUMBER 4918-78

W. O. NUMBER 246

7Mc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1 THRU 7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.
SHALL NOT EXCEED 3 AMPS.

UNIT NO. ---- SERIAL NO. 0012 TEST TEMP. +75°F
TMC/S PART NUMBER 816780-3 REV. E

[illegible]

B. Zuniga

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S

TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMc/S	PART NAME	SAFETY & ARMING DEVICE
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
10	10	10
11	11	11
12	12	12
13	13	13
14	14	14
15	15	15
16	16	16
17	17	17
18	18	18
19	19	19
20	20	20
21	21	21
22	22	22
23	23	23
24	24	24
25	25	25
26	26	26
27	27	27
28	28	28
29	29	29
30	30	30
31	31	31
32	32	32
33	33	33
34	34	34
35	35	35
36	36	36
37	37	37
38	38	38
39	39	39
40	40	40
41	41	41
42	42	42
43	43	43
44	44	44
45	45	45
46	46	46
47	47	47
48	48	48
49	49	49
50	50	50
51	51	51
52	52	52
53	53	53
54	54	54
55	55	55
56	56	56
57	57	57
58	58	58
59	59	59
60	60	60
61	61	61
62	62	62
63	63	63
64	64	64
65	65	65
66	66	66
67	67	67
68	68	68
69	69	69
70	70	70
71	71	71
72	72	72
73	73	73
74	74	74
75	75	75
76	76	76
77	77	77
78	78	78
79	79	79
80	80	80
81	81	81
82	82	82
83	83	83
84	84	84
85	85	85
86	86	86
87	87	87
88	88	88
89	89	89
90	90	90
91	91	91
92	92	92
93	93	93
94	94	94
95	95	95
96	96	96
97	97	97
98	98	98
99	99	99
100	100	100

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS _____ 1 THRU 7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.

UNIT NO. --

SERIAL NO. 0013

TEST TEMP. +75°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. Zuniga
TECHNICIAN

B. PURINTON
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S * ROTOR DID NOT ROTATE

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOS NUMBER 4918-78

W. O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1 THRU 7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3

UNIT NO. ----

SERIAL NO. 0014

TEST TEMP. +75°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. Zuniga

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S



TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1 THRU 7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

SHALL NOT EXCEED 3 AMPS

UNIT NO. ----

SERIAL NO. 0016

TEST TEMP. +75°F

TMc/S PART NUMBER 816780-3 REV. E

B. Zuniga
TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

7Mc/S PART NAME	SAFETY & ARMING DEVICE
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
24	24
25	25
26	26
27	27
28	28
29	29
30	30
31	31
32	32
33	33
34	34
35	35
36	36
37	37
38	38
39	39
40	40
41	41
42	42
43	43
44	44
45	45
46	46
47	47
48	48
49	49
50	50
51	51
52	52
53	53
54	54
55	55
56	56
57	57
58	58
59	59
60	60
61	61
62	62
63	63
64	64
65	65
66	66
67	67
68	68
69	69
70	70
71	71
72	72
73	73
74	74
75	75
76	76
77	77
78	78
79	79
80	80
81	81
82	82
83	83
84	84
85	85
86	86
87	87
88	88
89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1 THRU 7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

SHALL NOT EXCEED 3 AMPS

UNIT NO. ----

SERIAL NO. 0017

TEST TEMP. +75°F

TMC/S PART NUMBER 816780-3 REV. E

[illegible]

B. Zuniga

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

2. DISCREPANCY/S NOTED OF UNIT/S.

TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

ORIGINAL PAGE IS
OF POOR QUALITY

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W.O. NUMBER 246

7Mc/S PART NAME SAFETY & ARMING DEVICE

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.0.

UNIT NO. ----

SERIAL NO. 0006

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S

TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMC/S DWG. NUMBER 81678C REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS _____ 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.0.

UNIT NO. -----

SERIAL NO. 0007

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-7 REV. E (INERT PART)

[illegible]

B. ZUNIGA

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

XX ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
C DISCREPANCY/S NOTED OF UNIT/S_____

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

ORIGINAL PAGE IS
OF POOR QUALITY

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOS NUMBER 4918-78

W. O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.
AMPS SHALL NOT EXCEED 3.0.

UNIT NO. -----

SERIAL NO. 0008

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

X DISCREPANCY/S NOTED OF UNIT/S

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

ORIGINAL PAGE IS
OF POOR QUALITY

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W.O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.0.

UNIT NO. -----

SERIAL NO. 0010

TEST TEMP. +20°F

TMC/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA

B. PURINTON

TECHNICIAN

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

XX ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

2 DISCREPANCY/S NOTED OF UNIT/S



TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W.O. NUMBER 246

7Mc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS _____ 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.0.

UNIT NO. -----

SERIAL NO. 0011

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-3 REV. E

B. ZUNIGA

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

XX ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS _____ 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.0.

UNIT NO. _____

SERIAL NO. 0012

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA
TECHNICIAN

B. PURINTON
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

8 ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
DISCREPANCY/S NOTED OF UNIT/S _____

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 1CA00465

TMc/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.0.

UNIT NO. -----

SERIAL NO. 0014

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]B. ZUNIGA

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

XX ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W.O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.0.

UNIT NO. -----

SERIAL NO. 0015

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-7 REV. E (INERT PART)

[illegible]

B. ZUNIGA

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

2 ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

3 DISCREPANCY/S NOTED OF UNIT/S

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

ORIGINAL PAGE IS
OF POOR QUALITY

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10400465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.0.

UNIT NO. _____

SERIAL NO. 0016

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

XX ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMC/S PART NAME SAFETY & ARMING DEVICE

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.0

UNIT NO. -----

SERIAL NO. 0017

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA

TECHNICIAN

B. PURINTON

WITNESS

- VALUATION OF TEST RESULTS (CHECK ONE)

XX ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W.O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.
AMPS SHALL NOT EXCEED 3.0.

UNIT NO. -----

SERIAL NO. 0018

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

8 ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
DISCREPANCY/S NOTED OF UNIT/S_____

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W.O. NUMBER 246

TMc/S	PART NAME	SAFETY & ARMING DEVICE
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
10	10	10
11	11	11
12	12	12
13	13	13
14	14	14
15	15	15
16	16	16
17	17	17
18	18	18
19	19	19
20	20	20
21	21	21
22	22	22
23	23	23
24	24	24
25	25	25
26	26	26
27	27	27
28	28	28
29	29	29
30	30	30
31	31	31
32	32	32
33	33	33
34	34	34
35	35	35
36	36	36
37	37	37
38	38	38
39	39	39
40	40	40
41	41	41
42	42	42
43	43	43
44	44	44
45	45	45
46	46	46
47	47	47
48	48	48
49	49	49
50	50	50
51	51	51
52	52	52
53	53	53
54	54	54
55	55	55
56	56	56
57	57	57
58	58	58
59	59	59
60	60	60
61	61	61
62	62	62
63	63	63
64	64	64
65	65	65
66	66	66
67	67	67
68	68	68
69	69	69
70	70	70
71	71	71
72	72	72
73	73	73
74	74	74
75	75	75
76	76	76
77	77	77
78	78	78
79	79	79
80	80	80
81	81	81
82	82	82
83	83	83
84	84	84
85	85	85
86	86	86
87	87	87
88	88	88
89	89	89
90	90	90
91	91	91
92	92	92
93	93	93
94	94	94
95	95	95
96	96	96
97	97	97
98	98	98
99	99	99
100	100	100

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS _____ 1 THRU 7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.0.

UNIT NO. ----

SERIAL NO. 0019

TEST TEMP. +20°F

TMC/S PART NUMBER 816780-3 REV. E

[illegible]

NOTE: NO VOLTAGE OUTPUT INDICATION ON MONITOR, BUT TIMES RECORDED OFF CURRENT MONITOR WHICH COINCIDES WITH THE VOLTAGE APPLICATION.

B. Zuniga

B. Purinton

TECHNICIAN

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

3 DISCREPANCY/S NOTED OF UNIT/S _____ SEE SUMMARY SHEET, PAGE 2.

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-246

DATE 16 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

7Mc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1-7

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

AMPS SHALL NOT EXCEED 3.0.

UNIT NO. -----

SERIAL NO. 0020

TEST TEMP. +20°F

TMC/S PART NUMBER 816780-3 REV. E

[illegible]

B. ZUNIGA

TECHNICIAN

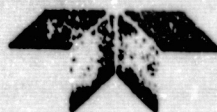
B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
INSULATION RESISTANCE

REPORT NUMBER 4918-246

DATE 18 JANUARY 1978

JOB NUMBER 4918-78

W.O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 1 THRU 7

REQUIREMENTS WITH THE ROTOR IN THE SAFE POSITION, THE INSULATION RESISTANCE BETWEEN
CURRENT CARRING PARTS AND THE CASE SHALL BE GREATER THAN 100 MEGOHMS AT 500 VDC.

UNIT S/N	MEGOHMS - PIN (SHOWN BELOW) TO CASE												
	F	G	H	J	K	L	M	N	P	R	S	T	U
0007	3.4K	7K	7.5K	7.5K	3.6K	9K	3.6K	3.8K	5K	5K	6K	6.5K	6K
0019	3.4K	6K	7K	7K	3.4K	8K	3.6K	6.2K	5K	5K	6K	7K	6K
0014	3K	6K	7K	7K	3.6K	9K	4K	4K	5K	5K	6K	7K	7K
0008	3K	5K	6K	6K	3K	7K	3.6K	3.8K	4.5K	5K	5K	6K	6K
0015	3K	5K	6K	6K	3K	7K	3.6K	3.6K	4.5K	5K	5K	6K	5K
0010	3K	5K	6K	7K	3.4K	8K	3.6K	4K	5K	5K	5K	7K	6K
0012	3K	5K	6K	6K	3K	7K	3.4K	3.6K	4K	5K	5K	6K	5K
0018	28K	5K	5K	5K	2.8K	5K	3K	3K	3.8K	4K	4K	5K	4K
0016	3.6K	4.5K	5K	5K	2.6K	5K	2.8K	3K	3.6K	4K	4K	5K	4.5K
0006	2.6K	4K	5K	5K	2.8K	6K	3K	3.2K	3.8K	4K	4K	5K	5K

B. Zuniga
TECHNICIAN

B. PURINTON
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S _____



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
CIRCUITRY CHECKS

ORIGINAL PAGE IS
OF POOR QUALITY

REPORT NUMBER 4918-246

DATE 18 JANUARY 1978

JOB NUMBER 4918-78

W.O. NUMBER 246

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S PROCEDURE ATP 816780 REV. B

REQUIREMENTS: SAFE POSITION

ARMED POSITION

A) G-H, K-N, P-R & S-T PIN TO PIN VOLTAGE
SHALL BE LESS THAN 750 MILLIVOLTS @
2.5 AMPERES

A) J-H, K-L, R-N, & T-U PIN TO PIN VOLTAGE
SHALL BE LESS THAN 750 MILLIVOLTS @ 2.5
AMPERES.

B) J-H, K-L, R-N & T-U PIN TO PIN SHOULD
INDICATE AN OPEN CIRCUIT.

B) G-H, K-N, P-R & S-T PIN TO PIN SHOULD

C) SOLENOID RESISTANCE SHALL BE 10.52-
11.72 Ohms

INDICATE AN OPEN CIRCUIT.

UNIT S/N	①	RECORD VOLTAGE READING OR WRITE OPEN IN EACH COLUMN BELOW										SOLENOID	TARE VOLTAGE
		G-H	K-N	P-R	S-T	J-H	K-L	R-N	T-U	F-M	V-CASE	OHMS	
0007	S	0.24	0.19	0.18	0.33	OPEN	OPEN	OPEN	OPEN	0.12	0.25	10.94	0.43
	A	OPEN	OPEN	OPEN	OPEN	0.17	0.17	0.19	0.21	----	----		
0019	S	0.20	OPEN	0.19	0.30	OPEN	OPEN	OPEN	OPEN	0.14	0.20	OPEN *	0.46
	A	OPEN	OPEN	OPEN	OPEN	0.17	0.18	OPEN	0.18	----	----		
0014	S	0.22	0.22	0.20	0.46	OPEN	OPEN	OPEN	OPEN	0.12	0.23	11.00	0.44
	A	OPEN	OPEN	OPEN	OPEN	0.17	0.20	0.20	0.22	----	----		
0008	S	0.28	0.22	0.21	0.43	OPEN	OPEN	OPEN	OPEN	0.22	0.32	11.02	0.44
	A	OPEN	OPEN	OPEN	OPEN	0.25	0.26	0.20	0.22	----	----		
0015	S	0.20	0.22	0.20	0.32	OPEN	OPEN	OPEN	OPEN	0.12	0.16	10.91	0.44
	A	OPEN	OPEN	OPEN	OPEN	0.18	0.24	0.22	0.18	----	----		
0010	S	0.22	0.22	0.20	0.38	OPEN	OPEN	OPEN	OPEN	0.12	0.20	10.97	0.44
	A	OPEN	OPEN	OPEN	OPEN	0.18	0.22	0.22	0.20	----	----		
0012	S	0.22	0.20	0.18	0.29	OPEN	OPEN	OPEN	OPEN	0.11	0.18	10.87	0.45
	A	OPEN	OPEN	OPEN	OPEN	0.16	0.19	0.19	0.27	----	----		
* SOLENOID RESISTANCE 10.99 CHECKED M-K													

① UNIT POSITION S = SAFE A = ARM

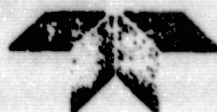
B. Zuniga
TECHNICIAN

B. Purinton
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

1 ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

2 DISCREPANCY/S NOTED OF UNIT/S S/N 0019 - See Summary Sheet, page 2.



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
CIRCUITRY CHECKS

REPORT NUMBER 4918-246

DATE 18 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

TMC/S PART NAME SAFETY & ARMING DEVICE

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

REQUIREMENTS: SAFE POSITION					ARMED POSITION				
A) G-H, K-N, P-R & S-T PIN TO PIN VOLTAGE SHALL BE LESS THAN 750 MILLIVOLTS @ 2.5 AMPERES					A) J-H, K-L, R-N, & T-U PIN TO PIN VOLTAGE SHALL BE LESS THAN 750 MILLIVOLTS @ 2.5 AMPERES.				
B) J-H, K-L, R-N & T-U PIN TO PIN SHOULD INDICATE AN OPEN CIRCUIT.					B) G-H, K-N, P-R & S-T PIN TO PIN SHOULD INDICATE AN OPEN CIRCUIT.				
C) SOLENOID RESISTANCE SHALL BE 10.52-11.72 ohms									

UNIT S/N	①	RECORD VOLTAGE READING OR WRITE OPEN IN EACH COLUMN BELOW										SOLENOID OHMS	TARE VOLTAGE
		G-H	K-N	P-R	S-T	J-H	K-L	R-N	T-U	F-M	V-CASE		
0018	S	0.20	0.21	0.18	0.34	OPEN	OPEN	OPEN	OPEN	0.18	0.13	10.98	0.45
	A	OPEN	OPEN	OPEN	OPEN	0.17	0.20	0.20	0.62	----	----		
0016	S	0.19	0.21	0.18	0.37	OPEN	OPEN	OPEN	OPEN	0.12	0.11	11.00	0.45
	A	OPEN	OPEN	OPEN	OPEN	0.16	0.24	0.21	0.27	----	----		
0006	S	0.19	0.21	0.19	0.29	OPEN	OPEN	OPEN	OPEN	0.13	0.17	10.90	0.45
	A	OPEN	OPEN	OPEN	OPEN	0.15	0.20	0.23	0.19	----	----		
	S												
	A												
	S												
	A												
	S												
	A												
	S												
	A												
	S												
	A												

① UNIT POSITION S = SAFE A = ARM

B. Zuniga
TECHNICIAN

B. Purinton
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
C DISCREPANCY/S NOTED OF UNIT/S



**TEST DATA SHEET
FOR
CONTINUITY TEST**

ORIGINAL PAGE IS
OF POOR QUALITY

REPORT NUMBER 4918-246

DATE 18 JANUARY 1978

JOB NUMBER 4918-78

W. O. NUMBER 246

THE/S PART NAME SAFE AND ARMING DEVICE

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465 REV. C

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS

REQUIREMENTS SHALL BE OPEN CIRCUIT FROM U TO ALL PINS

[illegible]

B. Zuniga
TECHNICIAN

B. Purinton
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S _____

APPENDIX A

LOT ACCEPTANCE TEST REPORT
FOR
EXPLOSIVE LEAD ASSEMBLY
TMc/S P/N 817187 REV. N/C

LOT ACCEPTANCE	TEST REPORT	JOB NO. 4918-78-234
TMCS DRAWING NO. 817187 REV. N/C		REPORT NO. 4918-234
CUST. DRAWING NO. N/A		LOT NO. N/A
ITEM EXPLOSIVE LEAD ASSEMBLY		

	TEST PERFORMED BY TELEDYNE MCCORMICK SELPH HOLLISTER, CALIFORNIA
	TEST AUTHORIZED BY NASA/MSFC

	DATE	SIGNATURE
TEST ENGINEER	3/20/78	<i>Harry Lane</i>
PROJECT ENGINEER	3/20/78	<i>Frank Mortels</i>
RELIABILITY	3/20/78	<i>H. A. Dixon</i>
FINAL RELEASE TEST DATA SECTION	3/20/78	<i>Reggie Hore</i>

 TELEDYNE McCORMICK SELPH

JOB NUMBER 4918-78 W.O. 234

REPORT NUMBER 4918-234

DATE 10 NOVEMBER 1977

PURPOSE OF TEST

LOT ACCEPTANCE ☒

DEVELOPMENT ☐

PREPROD/ PERIODIC / QUAL ☐

ENG. EVALUATION ☐

PRELOAD ☐

FAILURE ANALYSIS ☐

PERFORMANCE INSTRUCTIONS

PERFORM LOT ACCEPTANCE TESTING IN ACCORDANCE WITH TMc/S TEST PROCEDURE

ATP 816780 REV. A, PARAGRAPH 6.2.

TEST SUMMARY SHEET

JOB NUMBER 4918-78-234

REPORT NUMBER 4918-234

TMc/S PART NUMBER 817187 REV. N/C

CUSTOMER SPECIFICATION 10A00465 REV. C Tmc/S PROCEDURE ATP 816780 REV. A DATE TEST COMPLETED 10 NOVEMBER 1977

TYPE OF TEST	② REFERENCE PARAGRAPH	MEASURED VALUES		NUMBER OF UNITS		REMARKS AND/OR UNTOWARD INCIDENTS
		MINIMUM	MAXIMUM	TESTED	ACCEPTED	
AMBIENT FUNCTION	6.2	HIGH ORDER	DETONATION	10	10	NONE

Reference paragraphs (1) Customer Specification (2) TMC/S Procedure



TELEDYNE McCORMICK SELPH

Hollister, Calif. • 95023

TEST REPORT

JOB NUMBER 4918-78 W.O. 234

REPORT NUMBER 4918-234

DATE 10 NOVEMBER 1977

EQUIPMENT LIST

ITEM NO.	NAME	MANUFACTURER	MODEL	ACCURACY	CALIBRATION DUE DATE
1	TORQUE WRENCH	STURTEVANT	S-200-1	3% RDG.	1/21/78



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
AMBIENT FUNCTION

REPORT NUMBER 4918-234 DATE 10 NOVEMBER 1977
JOB NUMBER 4918-78 W.O. NUMBER 234
TMC/S PART NAME EXPLOSIVE LEAD ASSEMBLY TMC/S DWG. NUMBER 817187 REV. N/C
CUSTOMER SPECIFICATION 10A00465 REV. C TMC/S PROCEDURE ATP 816780 REV. A
TEST EQUIPMENT ITEM NUMBERS 1
REQUIREMENTS HIGH ORDER DETONATION

CUSTOMER PART NUMBER N/A

UNIT NUMBER	SERIAL NUMBER	RESULTS
1	1	HIGH ORDER DETONATION
2	2	HIGH ORDER DETONATION
3	3	HIGH ORDER DETONATION
4	4	HIGH ORDER DETONATION
5	5	HIGH ORDER DETONATION
6	6	HIGH ORDER DETONATION
7	7	HIGH ORDER DETONATION
8	8	HIGH ORDER DETONATION
9	9	HIGH ORDER DETONATION
10	10	HIGH ORDER DETONATION

B. Cash
TECHNICIAN

B. Purinton
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S _____

APPENDIX B

APPROVED ENGINEERING TEST LABORATORIES

TEST REPORT NUMBER 773-2612-1

(40 PAGES)



APPROVED ENGINEERING TEST LABORATORIES / 1536 EAST VALENCIA / FULLERTON, CALIFORNIA 92631 / TEL. (714) 879-6110
A NATIONAL TECHNICAL SERVICES COMPANY

11 January 1978

FULLERTON DIVISION REPORT NUMBER 773-2612-1
Teledyne McCormick Selph P. O. Number 96064RR, Item 1

- A. TEST: Acceptance Random Vibration
- B. TEST ITEMS: Sixteen (16) Safety and Arming Devices
TMc/S P/N 816780, S/N's 0005 thru 0020.
- C. SPECIFICATION: TMc/S Acceptance Test Procedure No.
ATP 816780, Revision B, paragraph 5.4.
- D. RESULTS: This is to certify that the test items were sub-
jected to the Acceptance Random Vibration Test
according to the above specification.

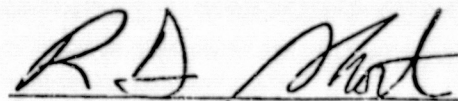
Each S&A was attached to the test fixture with
a bolt torque of 42 inch-pounds, and was set in
the ARMED position.

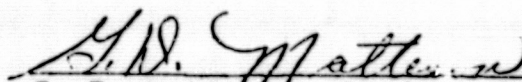
The position of the S&A was monitored during the
vibration and after each axis the S&A was switched
from SAFE to ARMED to SAFE and checked for elapsed
time by a TMc/S representative with the use of
TMc/S equipment.

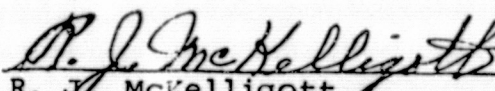
There was no visible evidence of damage result-
ing from the vibration. The test items were
returned to TMc/S for post-tests and final
evaluation.

Test data, an equipment list, and a test setup
photograph are attached.

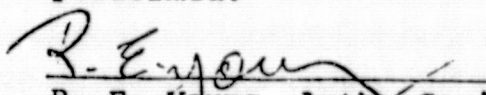
APPROVED ENGINEERING TEST LABORATORIES


R. D. Short, Division Manager

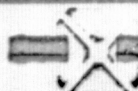

G. D. Matteson, Project Engineer


R. J. McKelligott,
Quality Assurance Manager

Required POA of listed items has been
performed.


R. E. Young, Auth. Gov't Rep. 1-12-78
Contract No. NAS8-31973

DCAS QAR



NTS

ED ENGINEERING TEST LABORATORIES
A NATIONAL TECHNICAL SERVICES CO.

Date Started: 1-9-78	AETL VIBRATION TEST DATA		M.J.O.: 773-2612
Date Completed: 1-9-78	Customer: TELEDYNE McCORMIC SELPH	Test: Random	Performed By: G.W. CAYER
Specimen Description: SAFETY AND ARMING DEVICE	Specimen Part No. 816780	S/N 00XX	Test Engineer: G. MATTESON
Specification: ATP 816780, REV. D, PARA. 5.4			Witnessed By: AETL 30 GC

Date	Time	Temperature	Frequency Bandwidth	P.S.D. Level	Roll-Up	Roll-Off	Acceleration Level	Duration	Axis	Test Sequence	Plot No.	Specimen Serial No.	Remarks
Day	Hour	°F	Hz	G ² /Hz	db/oct	db/oct	Grms	SEC.	X-Y-Z	Noted	Noted	Noted	Units
1-9-78	1132	AMB	20-40	—	3	—	8.7	N/A	X	1	1	DUMMY	EQUALIZATION S/N 7+15
			40-135	.02	—	—							
			135-250	—	3	—							
			250-440	.037	—	—							
			440-500	—	9	—							
			500-1100	.055	—	—							
			1100-2000	—	—	6							
	1157		SAME AS	ABOVE	8.8	60	X	2	2	19/13			RANDOM RUN
	1206		SAME AS	ABOVE	8.8	60	Z	3	3	19+13			RANDOM RUN
	1250		SAME AS	ABOVE	8.8	60	Z	4	4	20+12			RANDOM RUN
	1257		SAME AS	ABOVE	8.8	60	X	5	5	20+12			RANDOM RUN
	1305		SAME AS	ABOVE	8.8	60	X	6	6	5+8			RANDOM RUN
	1310		SAME AS	ABOVE	8.8	60	Z	7	7	5+8			RANDOM RUN
	1318		SAME AS	ABOVE	8.8	60	Z	8	8	17+6			RANDOM RUN
	1324		SAME AS	ABOVE	8.8	60	X	9	9	17+6			RANDOM RUN
	1331		SAME AS	ABOVE	8.8	60	X	10	10	11+10			RANDOM RUN
	1339		SAME AS	ABOVE	8.8	60	Z	11	11	11+10			RANDOM RUN
	1346		SAME AS	ABOVE	8.8	60	Z	12	12	18+9			RANDOM RUN
	1351		SAME AS	ABOVE	8.8	60	X	13	13	18+9			RANDOM RUN
V	1359	V	SAME AS	ABOVE	8.8	60	X	14	14	14+16			RANDOM RUN
1-9-78	1404	AMB	SAME AS	ABOVE	8.8	60	Z	15	15	14+16			RANDOM RUN

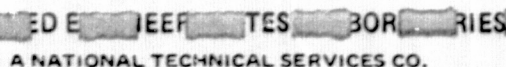


NOTED ENGINEERING TEST LABORATORIES
A NATIONAL TECHNICAL SERVICES CO.

NTS

Date Started:		AETL VIBRATION TEST DATA										M.J.O.:	
Date Completed:		Customer:				Test:				Performed By:			
Specimen Description:		Specimen Part No.				Random		Test Engineer:					
Specification:		Specimen Serial No.				Witnessed By:		AETL 20 06					
1-9-78		TELEDYNE McCORMICK SELPH				816780 S/N 00XX				773-2612			
1-9-78		SAFETY AND ARMING DEVICE				ATP 816780 REV. B., PARA. 5.4				G.W. CAYER			
1-9-78		G.M. MATTESON											
Date	Time	Temperature	Frequency Bandwidth	P.S.D. Level	Roll-Up	Roll-Off	Acceleration Level	Duration	Axis	Test Sequence	Plot No.	Specimen Serial No.	Remarks
Day	Hour	°F	Hz	G ² /Hz	db/oct	db/oct	Grms	SEC	X-Y-Z	Noted	Noted	Noted	Units
1-9-78	1418	AMB	20-40	—	3	—	8.8	60	Z	16	16	7+15	RANDOM RUN
			40-135	.02	—	—							
			135-250	—	3	—							
			250-440	.037	—	—							
			440-500	—	9	—							
			500-1100	.055	—	—							
			1100-2000	—	—	6							
	1423		SAME AS ABOVE				8.8	60	X	17	17	7+15	RANDOM RUN
	1459		20-30	—	3	—	11.4	60	Y	18	18	FIXTURE	EQUALIZATION
			30-53	.07	—	—							
			53-100	—	6	—							
			100-170	.25	—	—							
			170-2000	—	—	3							
	1505		SAME AS ABOVE				11.6	60	Y	19	19	15	RANDOM RUN
	1509		SAME AS ABOVE				11.6	60	Y	20	20	7	RANDOM RUN
	1514		SAME AS ABOVE				11.6	60	Y	21	21	16	RANDOM RUN
	1518		SAME AS ABOVE				11.6	60	Y	22	22	14	RANDOM RUN
	1521		SAME AS ABOVE				11.6	60	Y	23	23	13	RANDOM RUN
	1527		SAME AS ABOVE				11.6	60	Y	24	24	19	RANDOM RUN
Y	1532	Y	SAME AS ABOVE				11.6	60	Y	25	25	12	RANDOM RUN
1-9-78	1537	AMB	SAME AS ABOVE				11.6	60	Y	26	26	20	RANDOM RUN

ORIGINAL PAGE IS
OF POOR QUALITY



NTS

Date Started: 1-9-78	AETL VIBRATION TEST DATA		M.J.O.: 773-2612
Date Completed: 1-9-78	Customer: TELEDYNE McCORMICK SELPH	Test: Random	Performed By: G.W. CAYER
Specimen Description: SAFETY AND ARMING DEVICE	Specimen Part No. 816780	Test Engineer: G. MATTESON	
Specification: ATP 816780 REV. B. PARA. 5.4	Witnessed By:		AETL TO QC

Date	Time	Temperature	Frequency Bandwidth	P.S.D. Level	Roll-Up	Roll-Off	Acceleration Level	Duration	Axis	Test Sequence	Plot No.	Specimen Serial No.	Remarks
Day	Hour	°F	Hz	G ² /Hz	db/oct	db/oct	Grms	SEC	X-Y-Z	Noted	Noted	Noted	Units
1-9-78	1542	AMB	20-30	—	3	—	11.6	60	Y	27	27	0008	RANDOM RUN
			30-53	.07	—	—							
			53-100	—	6	—							
			100-170	.25	—	—							
			170-2000	—	—	3							
	1545		SAME AS	ABOVE	11.6	60	Y	28	28	5	RANDOM RUN		
	1549		SAME AS	ABOVE	11.6	60	Y	29	29	6	RANDOM RUN		
	1553		SAME AS	ABOVE	11.6	60	Y	30	30	17	RANDOM RUN		
	1556		SAME AS	ABOVE	11.6	60	Y	31	31	11	RANDOM RUN		
	1600		SAME AS	ABOVE	11.6	60	Y	32	32	10	RANDOM RUN		
Y	1604	Y	SAME AS	ABOVE	11.6	60	Y	33	33	18	RANDOM RUN		
1-9-78	1607	AMB	SAME AS	ABOVE	11.6	60	Y	34	34	9	RANDOM RUN		

NOTE: S+A DEVICE WAS TORQUED TO 42" LBS AND WAS IN ARMED POSITION DURING VIBRATION AND MONITORED FOR SAME WITH CUSTOMER TEST EQUIPMENT. ALSO AFTER EACH AXIS OF VIBRATION THE DEVICE WAS CYCLED FROM SAFE TO ARMED TO SAFE AND THIS ROTATION WAS CHECKED FOR ELAPSED TIME WITH CUSTOMER SUPPLIED TEST EQUIPMENT.

CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY+ARMING DEVICE

PART NO. 816780

SERIAL NO. DUMMIES

DATE 1-9-78

INPUT LEVEL 2.8 GRMS 2.7

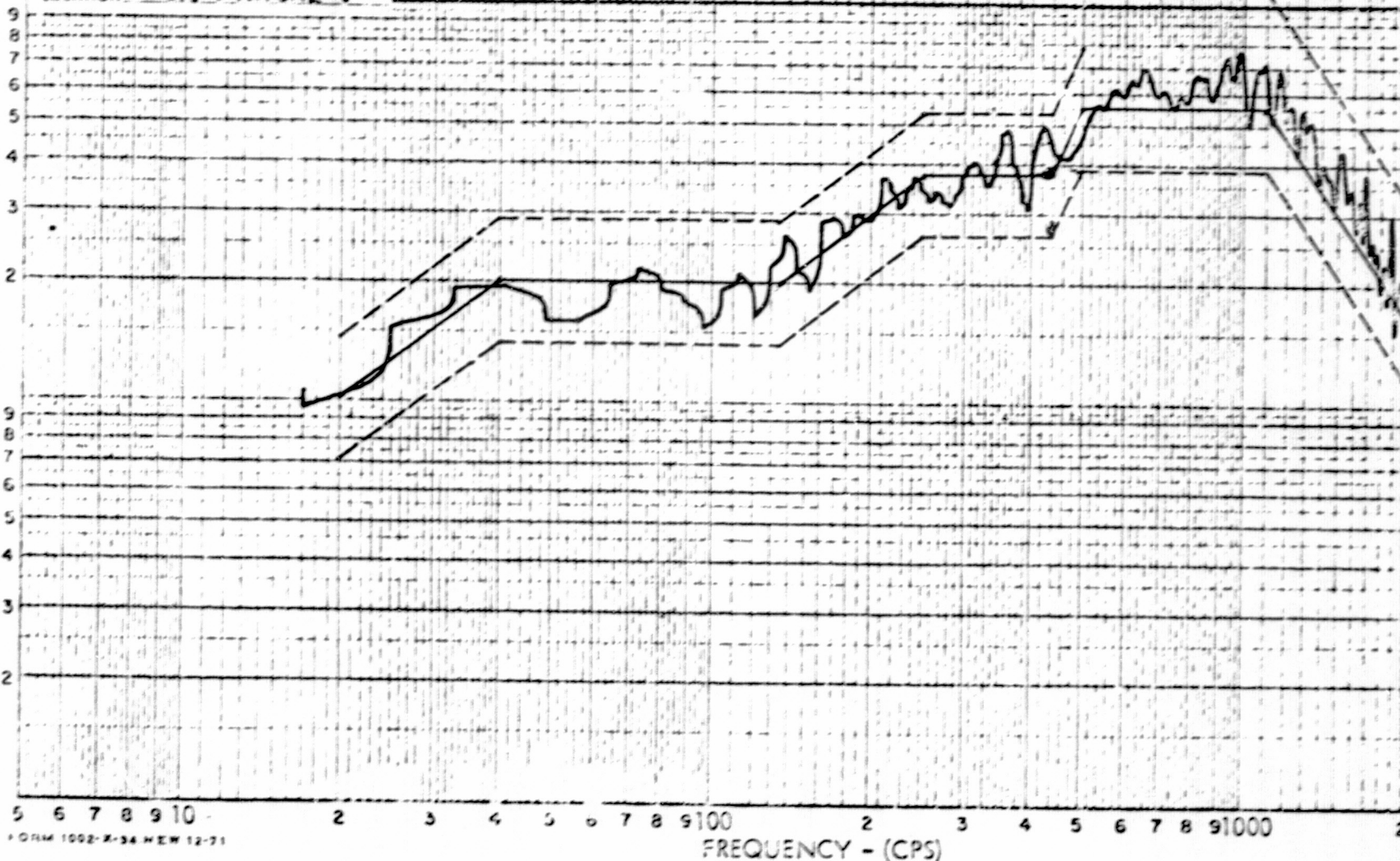
ACCELEROMETER NO. 1

ATTN X

LOCATION ON FIXTURE

EQUALIZATION

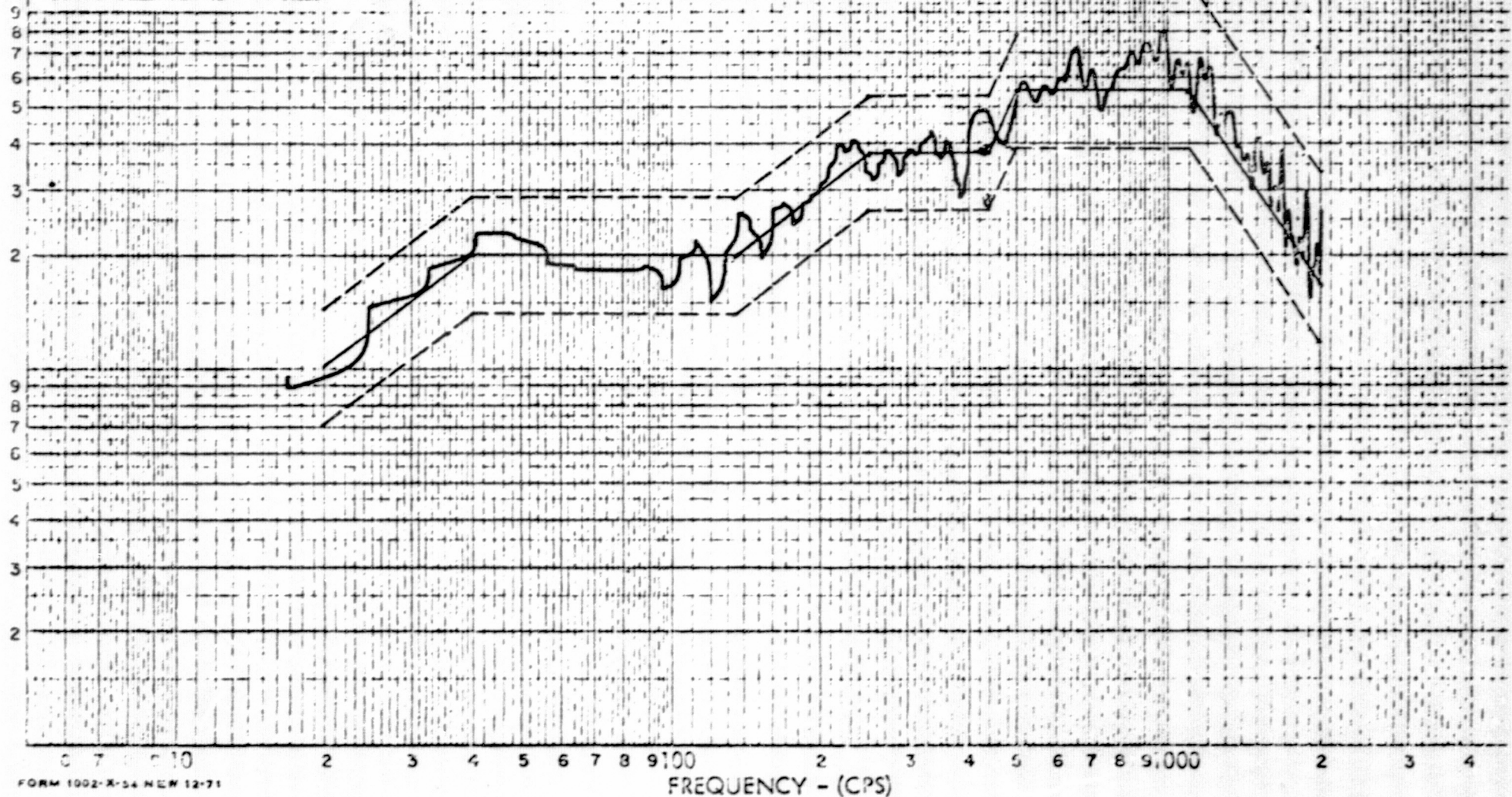
PLOT # 1



ORIGINAL PAGE IS
OF POOR QUALITY

CUSTOMER TELEDYNE McCORMICK SELPH
 MJO NO. 773-2612
 TEST ITEM SAFETY+ARMING DEVICE
 PART NO. 816780
 SERIAL NO. 0019 + 0013
 DATE 1-9-78
 INPUT LEVEL 8.8 GRMS 8.7
 ACCELEROMETER NO. 1
 AXIS X
 LOCATION ON FIXTURE.

PLOT # 2



CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY+ARMING DEVICE

PART NO. 816780

SERIAL NO. 0019 + 0013

DATE 1-9-78

INPUT LEVEL 8.8 GRMS 8.7

ACCELEROMETER NO. 1

AXIS Z

LOCATION ON FIXTURE

PLOT # 3

AF
30
QC

ORIGINAL PAGE IS
OF POOR QUALITY

5 6 7 8 9 10

2

3

4

5

6

7

8

9

100

2

3

4

5

6

7

8

9

1000

2

3

4

FREQUENCY - (CPS)

CUSTOMER TELEDYNE McCORMICK SELPH
MJO NO. 773-2612
TEST ITEM SAFETY+ARMING DEVICE
PART NO. 816780
SERIAL NO. 0020 + 0012
DATE 1-9-78
INPUT LEVEL 8.8 GRMS 8.7
ACCELEROMETER NO. 1
AXIS Z
LOCATION ON FIXTURE.

PLOT # 4

ATL
30
00

FREQUENCY - (CPS)

CUSTOMER **TELEDYNE McCORMICK SELPH**

MJO NO. **773-2612**

TEST ITEM **SAFETY+ARMING DEVICE**

PART NO. **816780**

SERIAL NO. **0020 + 0012**

DATE **1-9-78**

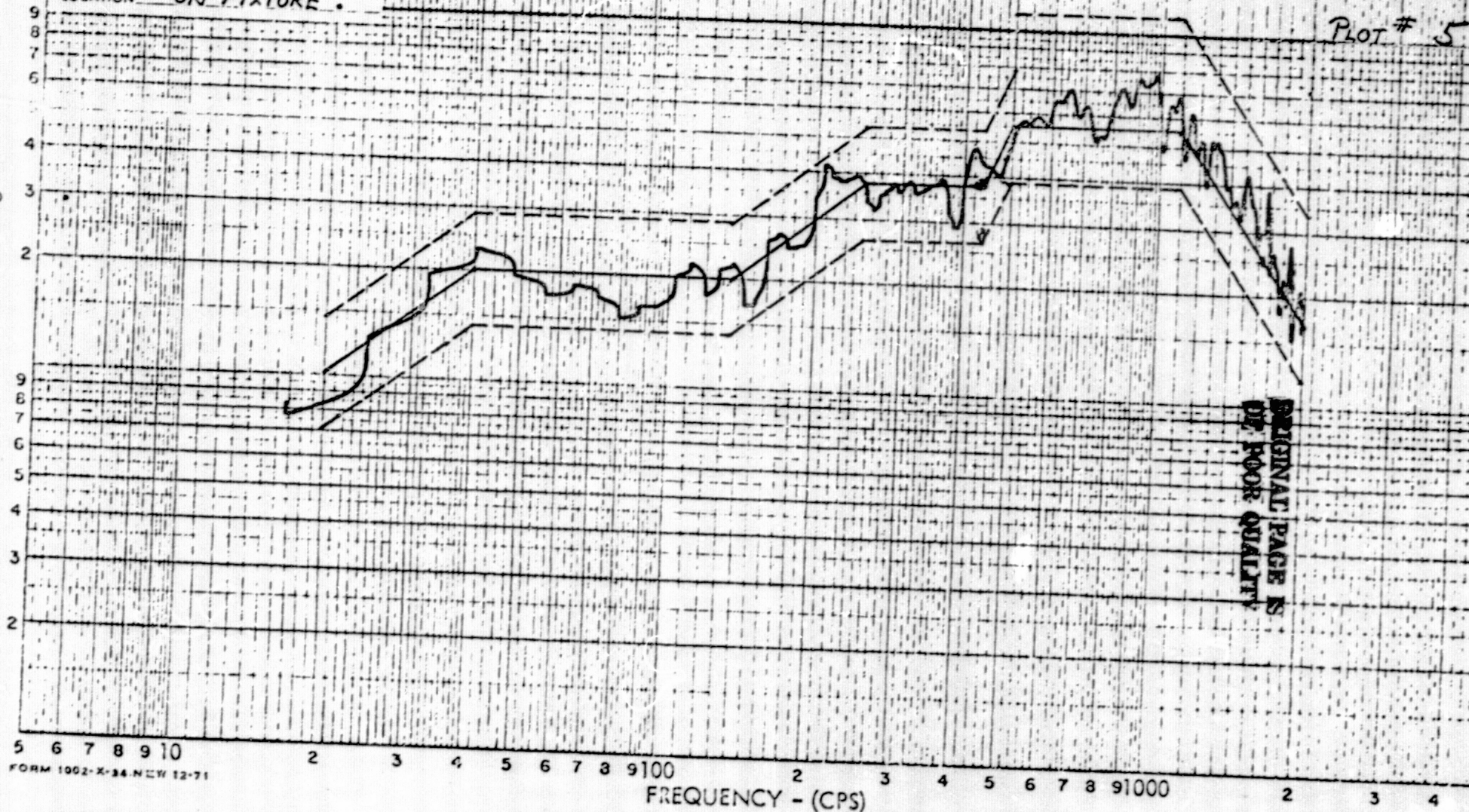
INPUT LEVEL **8.8 GRMS** 8.7

ACCELEROMETER NO. **1**

AXIS **X**

LOCATION **ON FIXTURE**

Plot # 5



FREQUENCY - (CPS)

CUSTOMER *TELEDYNE McCORMICK SELPH*

MJO NO. *773-2612*

TEST ITEM *SAFETY+ARMING DEVICE*

PART NO. *816780*

SERIAL NO. *0005 + 0008*

DATE *1-9-78*

INPUT LEVEL *8.8 GRMS* *8.7*

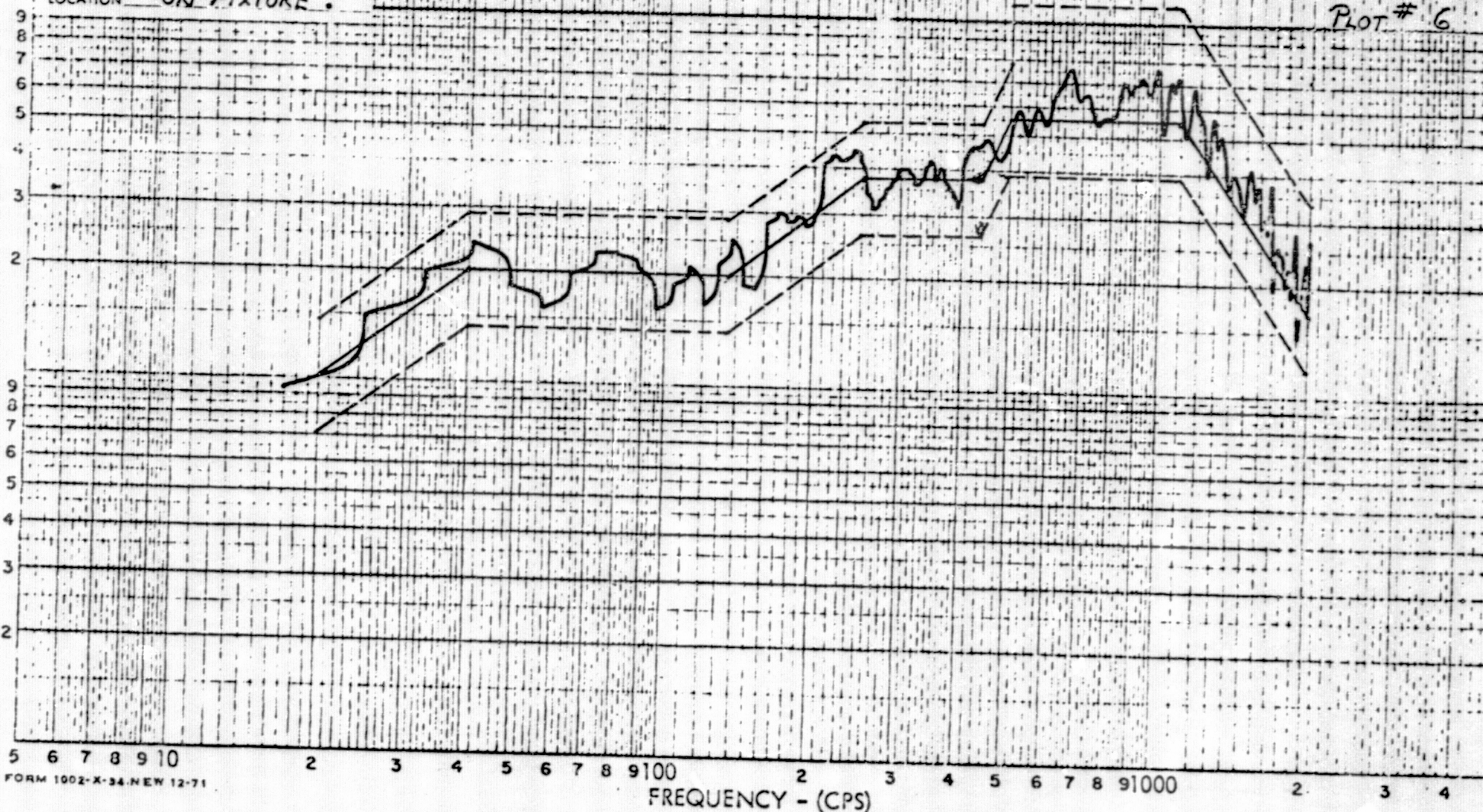
ACCELEROMETER NO. *1*

AXIS *X*

LOCATION *ON FIXTURE.*

ATL
32
8C

Plot # 6



9
8 CUSTOMER TELEDYNE McCORMICK SELPH

7 P.O. NO. 773-2612

6 TEST ITEM SAFETY+ARMING DEVICE

5 PART NO. 816780

4 SERIAL NO. 0005+0008

3 DATE 1-9-78

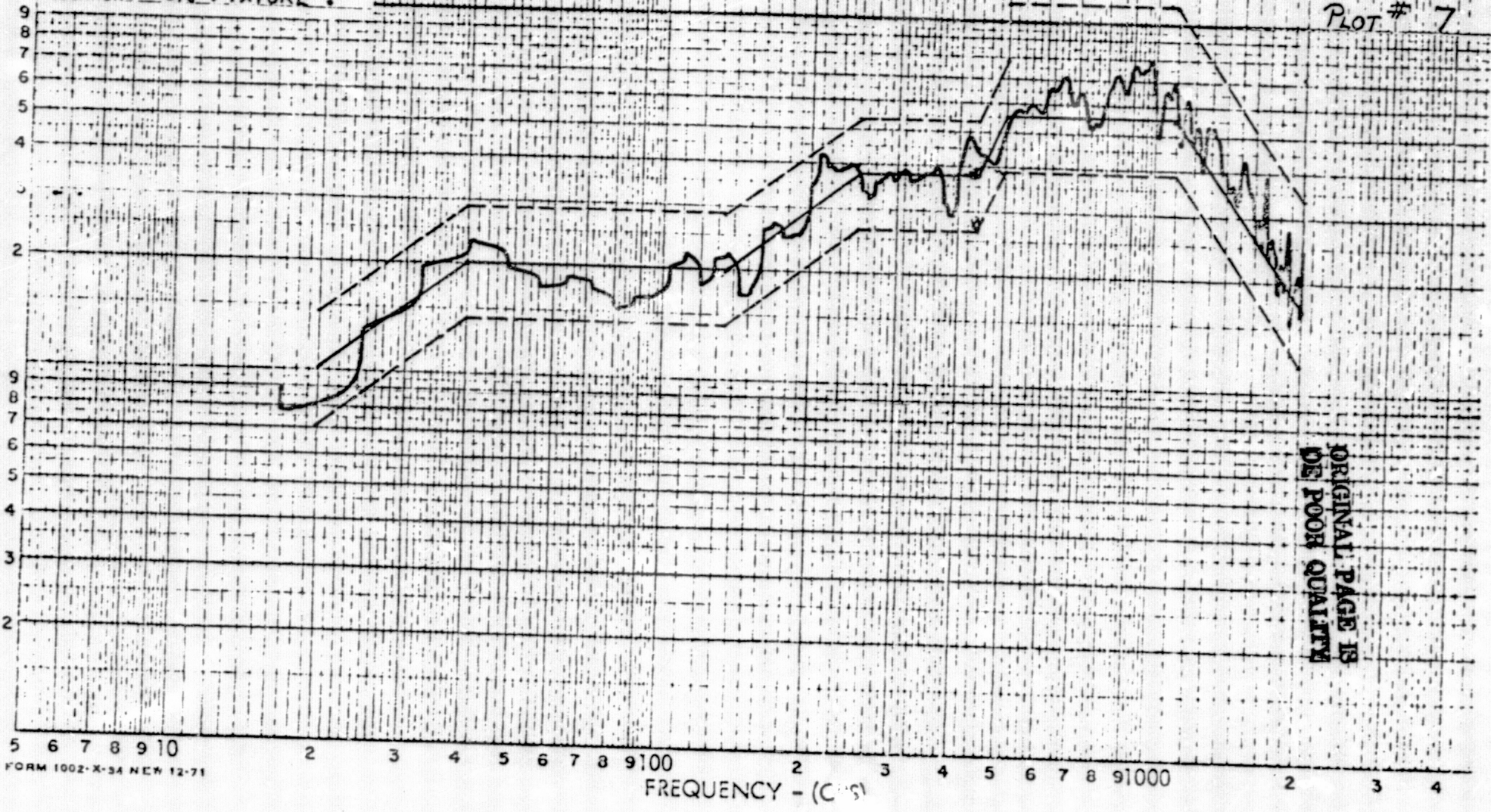
2 INPUT LEVEL 8.8 GRMS 8.7

ACCELEROMETER NO. 1

AXIS Z

LOCATION ON FIXTURE.

PLOT # 7



CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY+ARMING DEVICE

PART NO. 816780

SERIAL NO. 0017 + 0006

DATE 1-9-78

INPUT LEVEL 8.8 GRMS 8.7

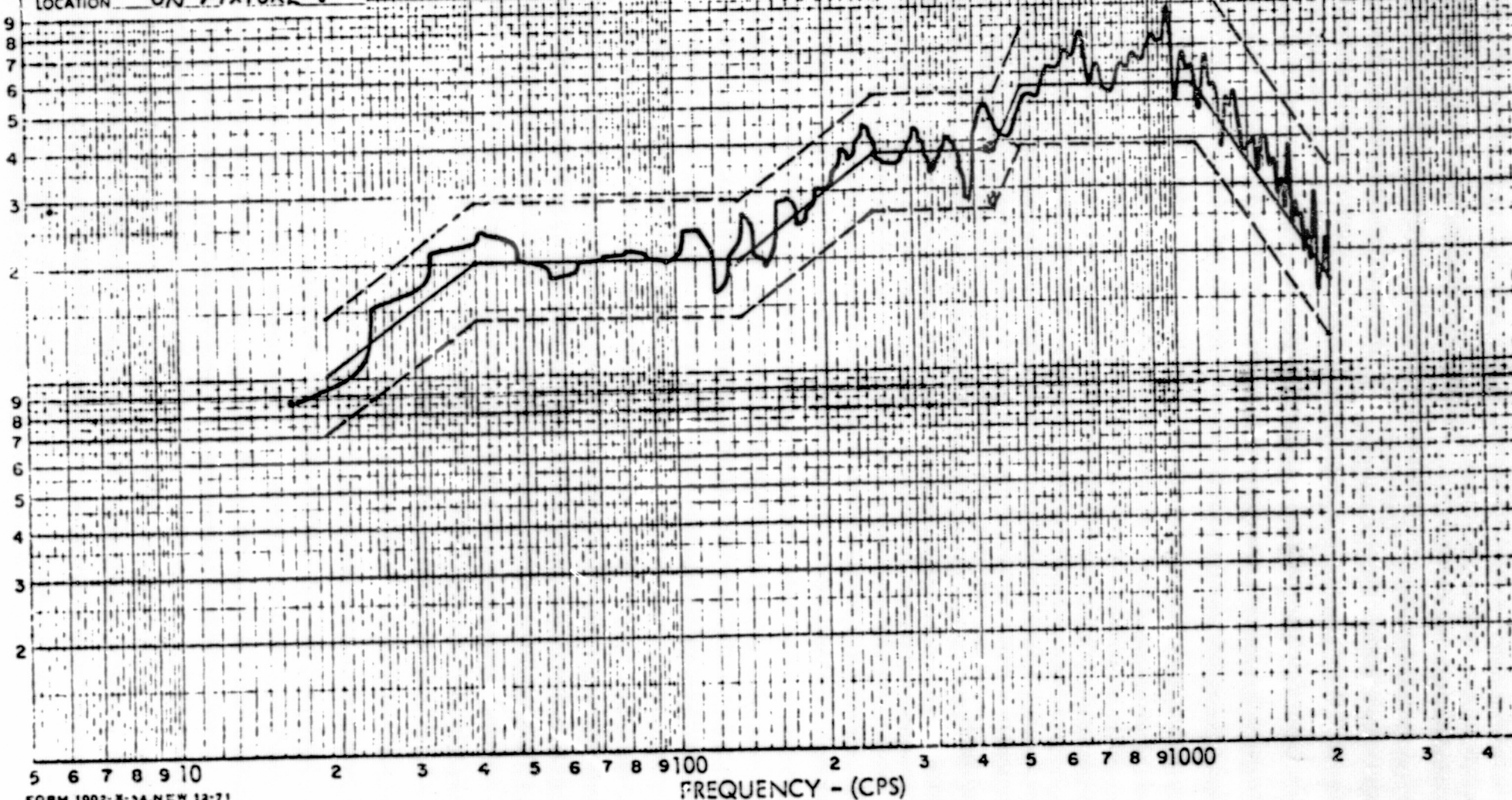
ACCELEROMETER NO. 1

AXIS Z

LOCATION ON FIXTURE.

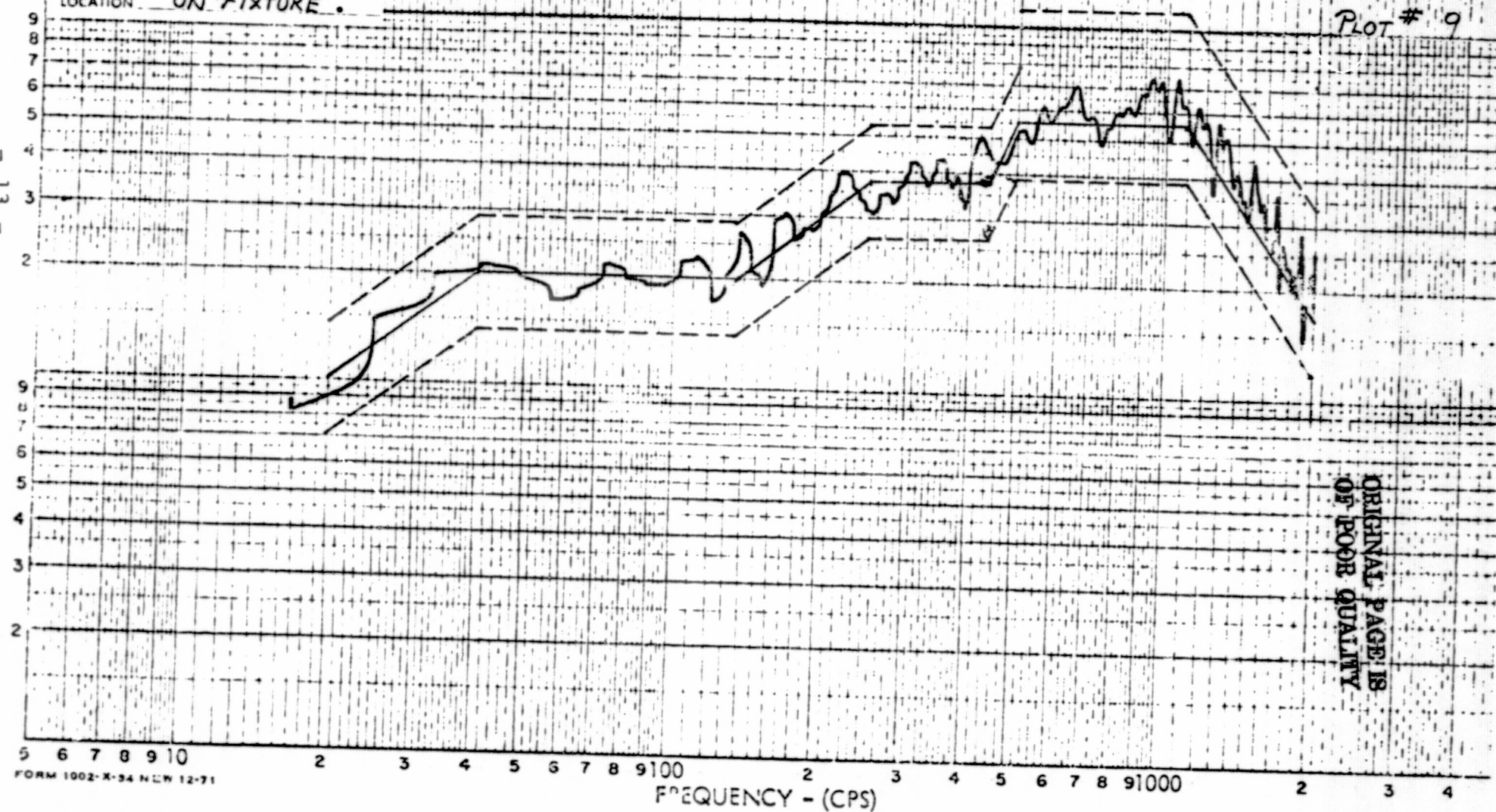
PLOT # 8

- 12 -



9 CUSTOMER *TELEDYNE McCORMICK SELPH*
7 MJO NO. *773-2612*
6
5 TEST ITEM *SAFETY+ARMING DEVICE*
4 PART NO. *816780*
3 SERIAL NO. *0017 + 0006*
2 DATE *1-9-78*
INPUT LEVEL *8.8 GRMS* *8.7*
ACCELEROMETER NO. *1*
AXIS *X*
LOCATION *ON FIXTURE.*

Plot # 9



ORIGINAL PAGE IS
OF POOR QUALITY

CUSTOMER TELEDYNE McCORMICK SELPH

AJO NO. 773-2612

TEST ITEM SAFETY+ARMING DEVICE

PART NO. 816780

SERIAL NO. 0011 + 0010

DATE 1-9-78

INPUT LEVEL 8.8 GRMS 8.7

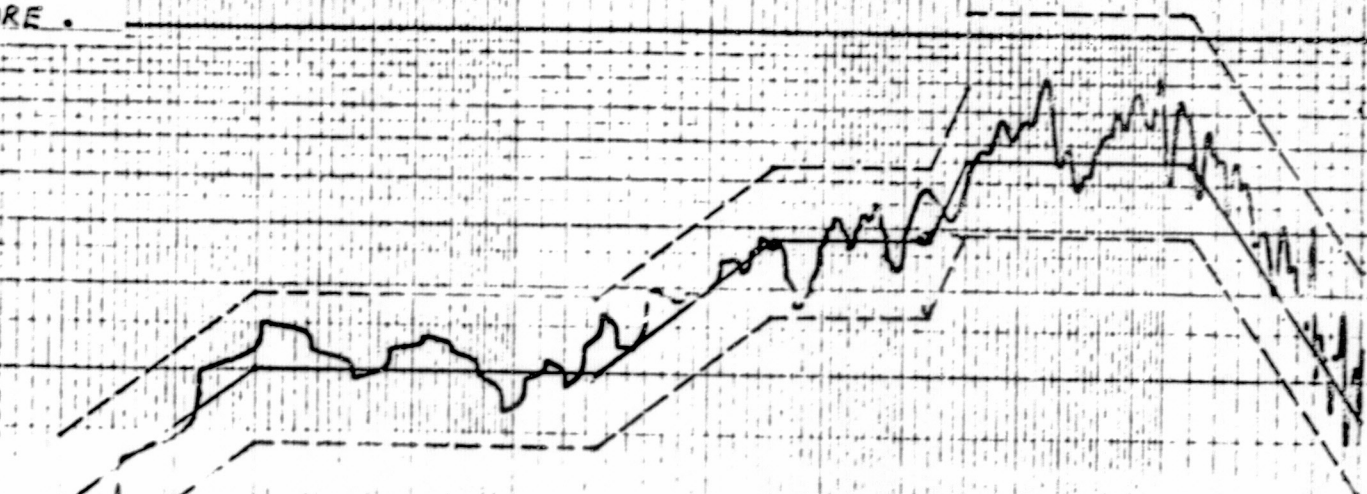
ACCELEROMETER NO. 1

AXIS X

LOCATION ON FIXTURE.

ACTL
30
GC

PLOT # 10



5 6 7 8 9 10

2

3

4

5

6

7

8

9

100

2

3

4

5

6

7

8

9

1000

2

3

4

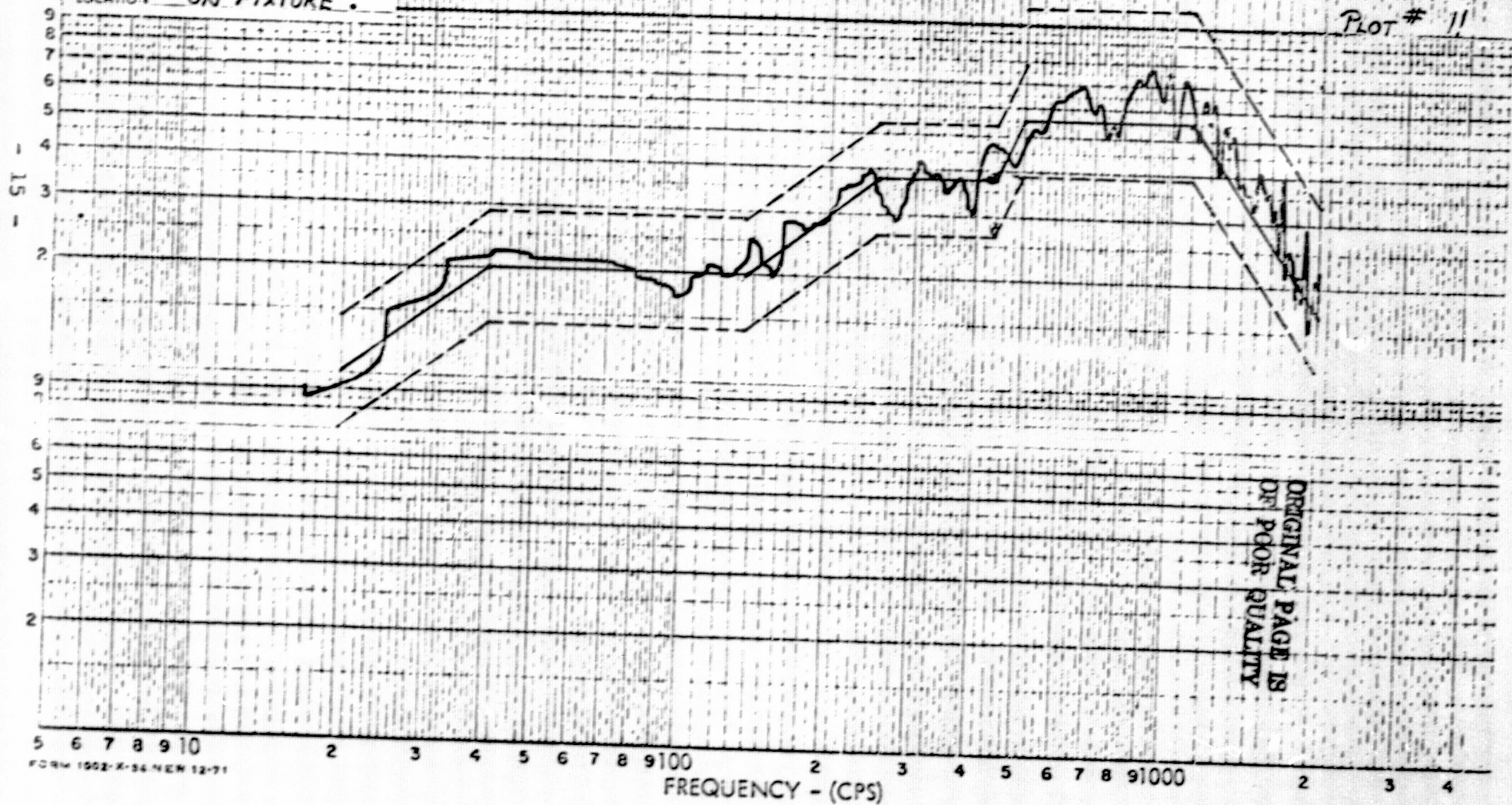
FORM 1002-X-34 NEW 12-71

FREQUENCY - (CPS)

9 CUSTOMER TELEDYNE McCORMICK JELPH
 8
 7 MJO NO. 773-2612
 6
 5 TEST ITEM SAFETY+ARMING DEVICE
 4 PART NO. 816780
 3 SERIAL NO. 0010+0011
 2 DATE 1-9-78
 INPUT LEVEL 8.8 GRMS 8.7
 ACCELEROMETER NO. 1
 AXIS Z
 LOCATION ON FIXTURE.

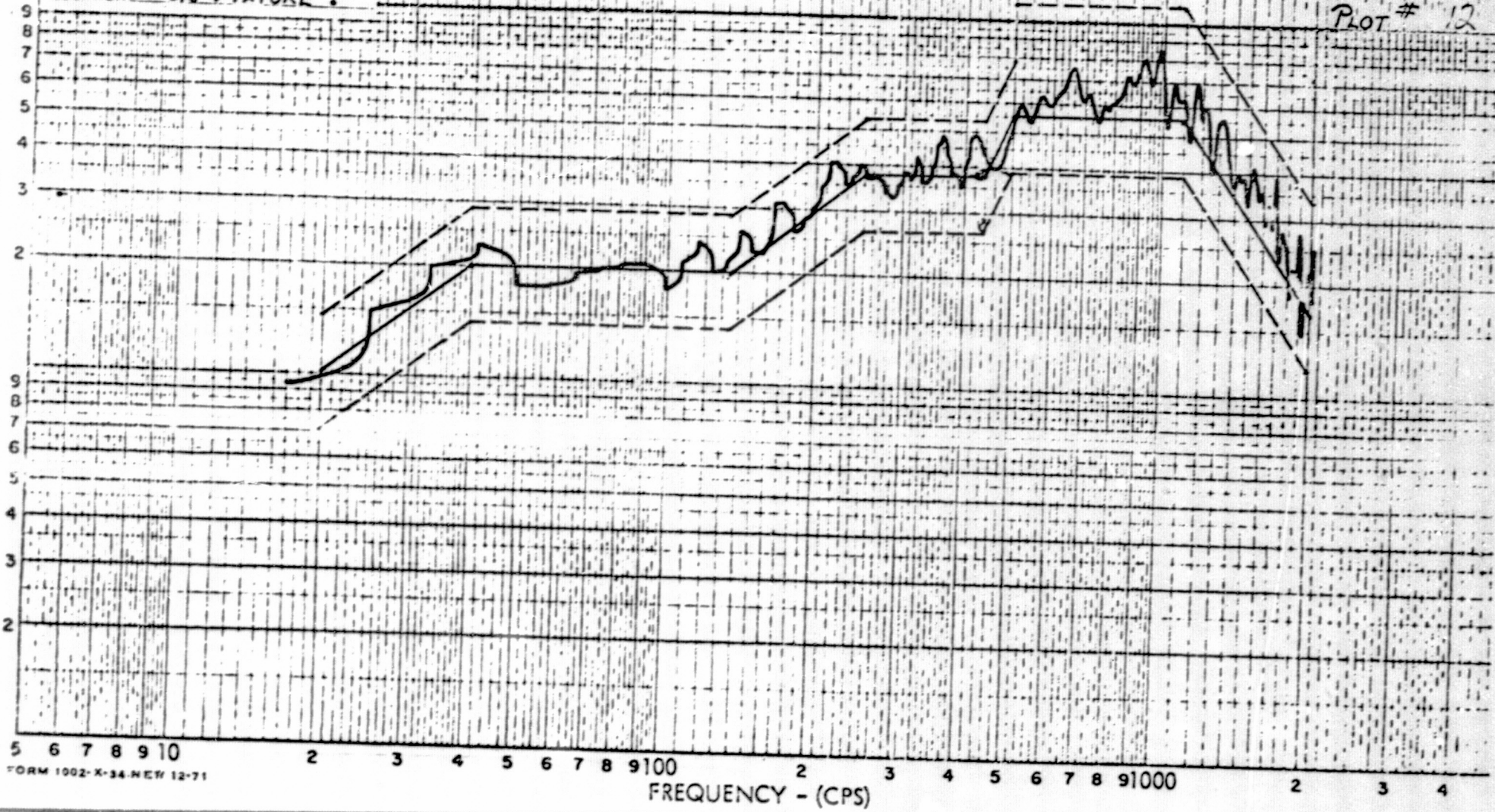
ATTL
 30
 60

PLOT # 11



TELEDYNE McCORMICK SELPH
MFG NO. 773-2612
TEST ITEM SAFETY+ARMING DEVICE
PART NO. 816780
SERIAL NO. 0009 +0018
DATE 1-9-78
INPUT LEVEL 8.8 GRMS 8.7
ACCELEROMETER NO. 1
AXIS Z
LOCATION ON FIXTURE.

PLOT # 12



CUSTOMER TELEDYNE McCORMICK SELPH

MAJO NO. 773-2612

TEST ITEM SAFETY+ARMING DEVICE

PART NO. 816780

SERIAL NO. 0018 + 0009

DATE 1-9-78

INPUT LEVEL 8.8 GRMS

ACCELEROMETER NO. 1

AXIS X

LOCATION ON FIXTURE

PLOT # 13

ORIGINAL PAGE IS
OF POOR QUALITY

5 6 7 8 9 10

FORM 1002-X-34 NEW 12-71

2

3

4

5

6

7

8

9

100

2

3

4

5

6

7

8

9

10

FREQUENCY

9 CUSTOMER TELEDYNE McCORMICK SELPH

8 MJO NO. 773-2612

7 TEST ITEM SAFETY+ARMING DEVICE

6 PART NO. 816780

5 SERIAL NO. 0014 + 0016

4 DATE 1-9-78

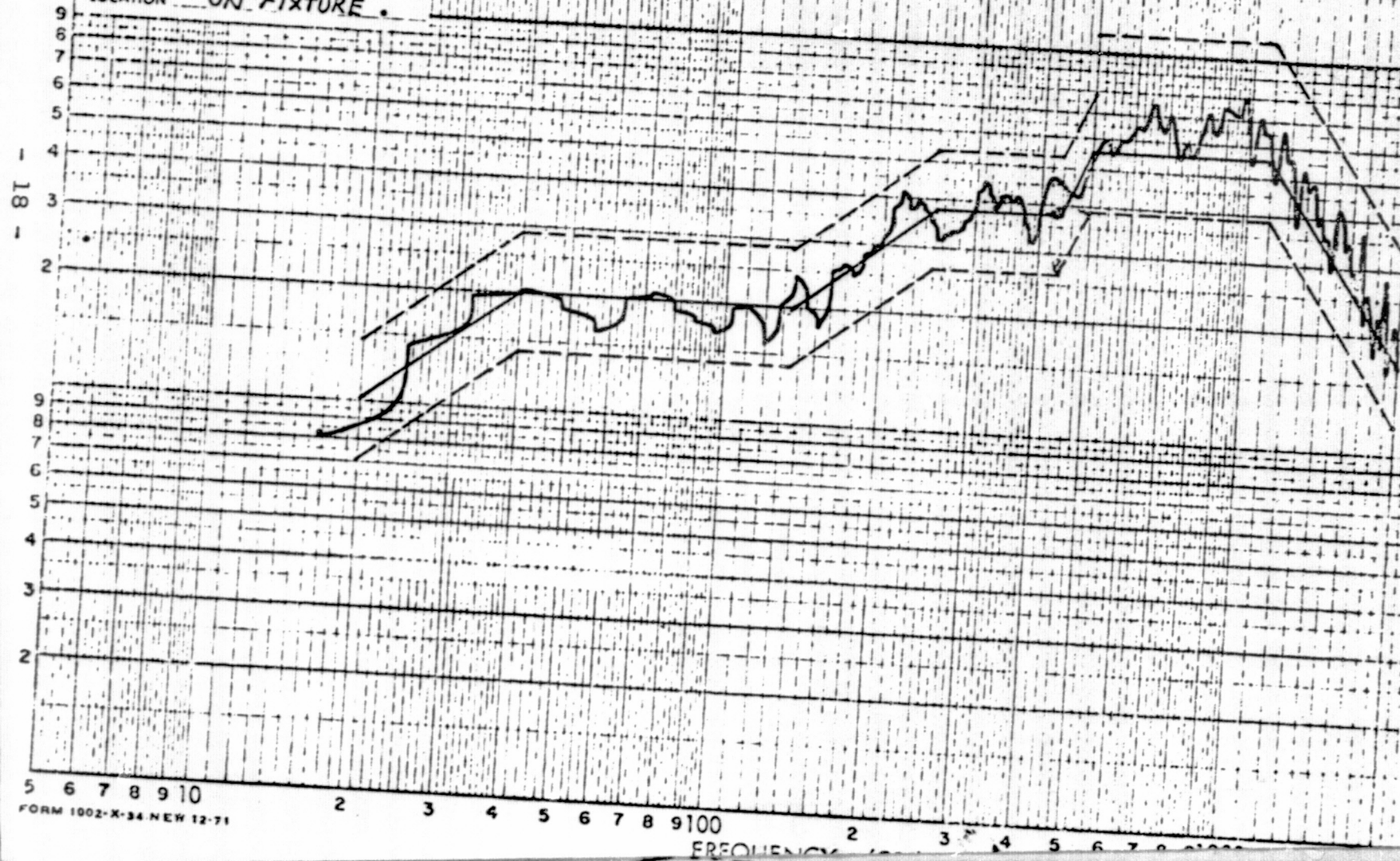
3 INPUT LEVEL 8.8 GRMS 8.7

2 ACCELEROMETER NO. 1

1 AXIS X

LOCATION ON FIXTURE.

PLOT # 14



CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY+ARMING DEVICE

PART NO. 816780

SERIAL NO. 0014+0016

DATE 1-9-78

INPUT LEVEL 8.8 GRMS 8.7

ACCELEROMETER NO. 1

AXIS Z

LOCATION ON FIXTURE

AET
130
9C

PLOT # 15

ORIGINAL PAGE IS
OF POOR QUALITY

FREQUENCY - (CPS)

CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY+ARMING DEVICE

PART NO. 816780

SERIAL NO. 0007+0015

DATE 1-9-78

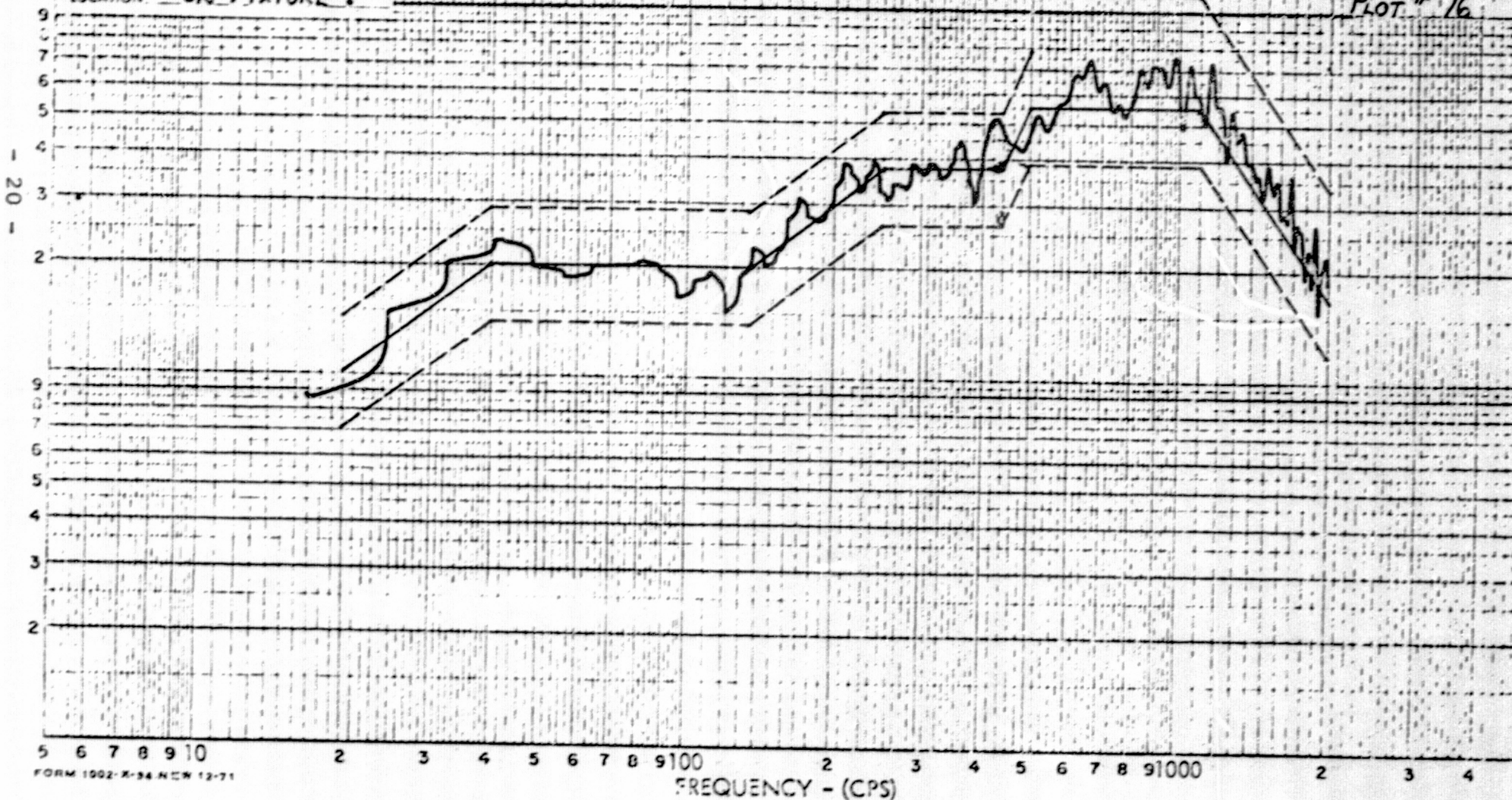
INPUT LEVEL 8.8 GRMS 8.7

ACCELEROMETER NO. 1

AXIS Z

LOCATION ON FIXTURE

PLOT # 16



CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY+ARMING DEVICE

PART NO. 816780

SERIAL NO. 0007 + 0015

DATE 1-9-78

INPUT LEVEL 8.8 GRMS 8.7

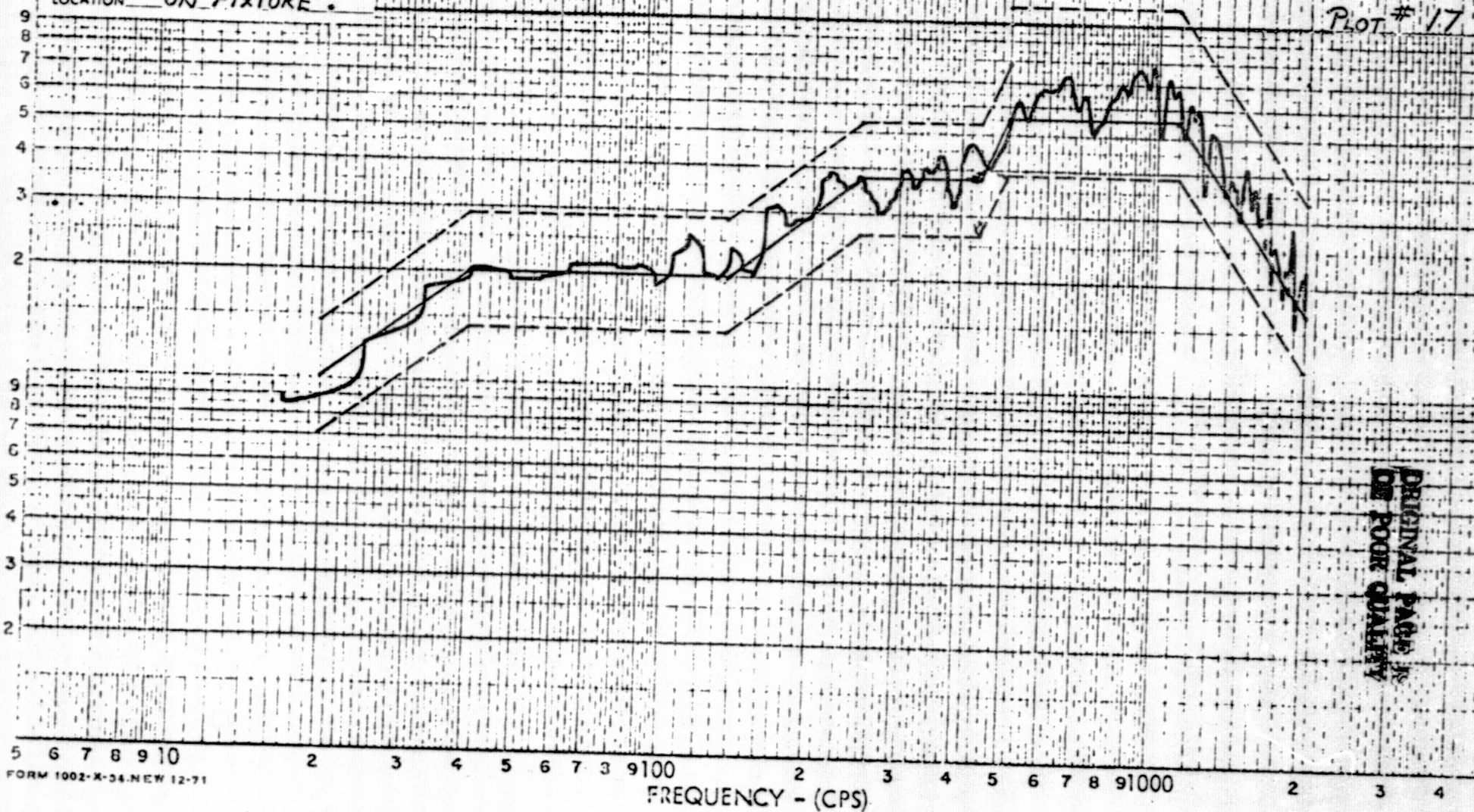
ACCELEROMETER NO. 1

AXIS X

LOCATION ON FIXTURE.

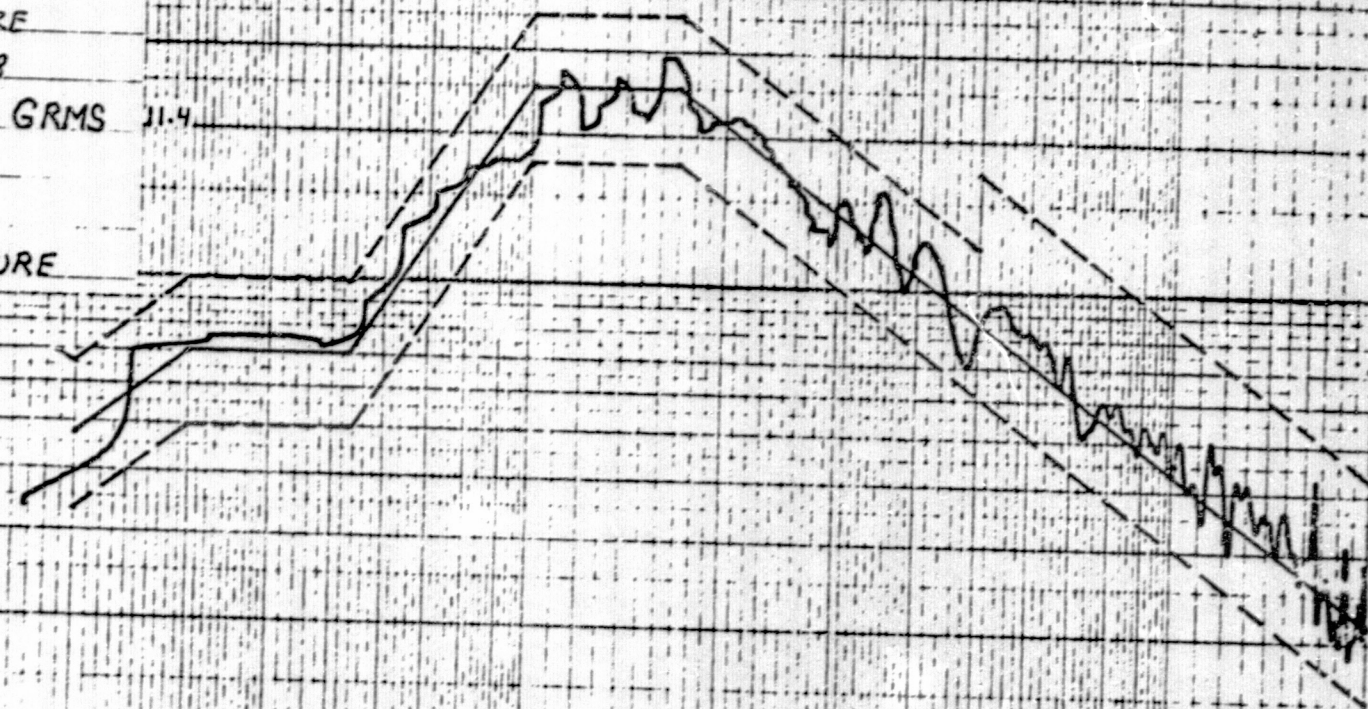
ACTL
30
00

PLOT # 17



ORIGINAL PAGE IS
OF POOR QUALITY

CUSTOMER **TELEDYNE Mc CORMICK SELPH**
MJO NO. **773-2612**
TEST ITEM **SAFETY & ARMING DEVICE**
PART NO. **816780**
SERIAL NO. **FIXTURE**
DATE **1-9-78**
INPUT LEVEL **11.4 GRMS** 11.4
ACCELEROMETER NO. **1**
AXIS **Y**
LOCATION **ON FIXTURE**



EQUALIZATION
PLOT # 18

CUSTOMER TELEDYNE Mc CORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY ARMING DEVICE

PART NO. 816780

SERIAL NO. 0015

DATE 1-9-78

INPUT LEVEL 11.6 GRMS 11.4

ACCELEROMETER NO. 1

AXIS Y

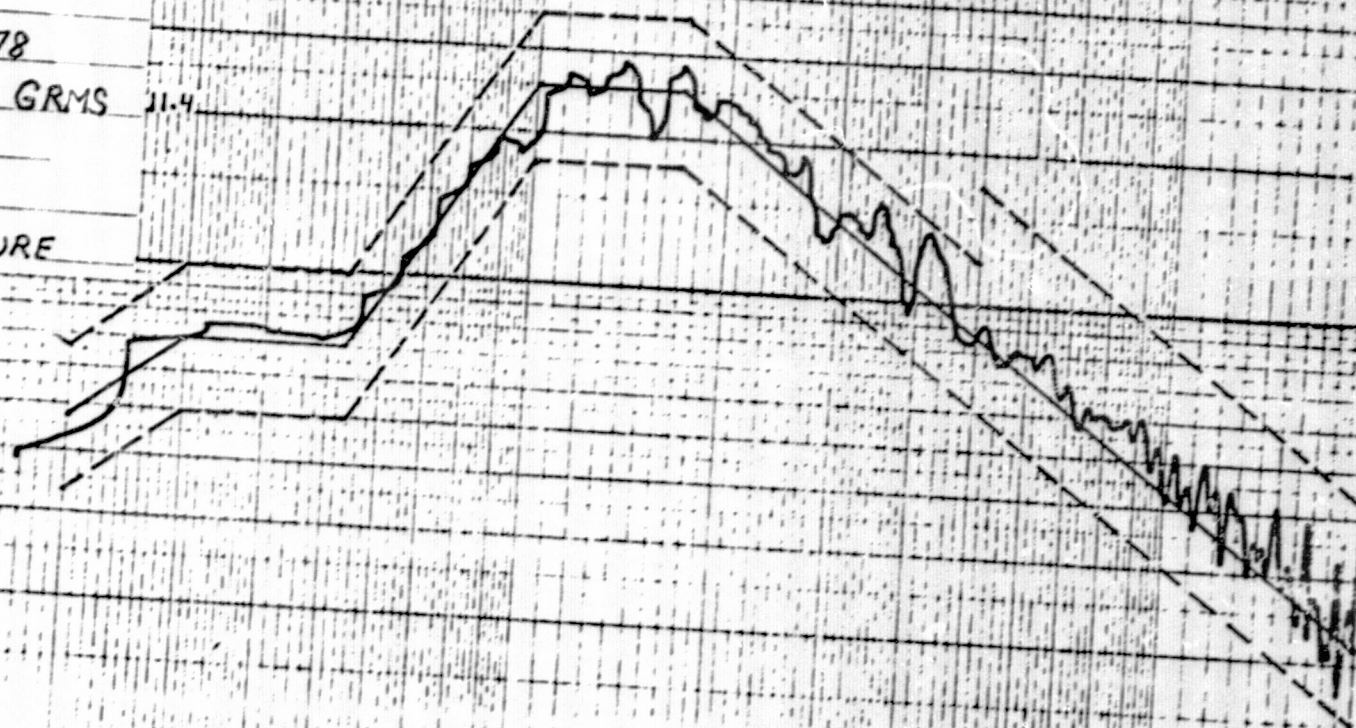
LOCATION ON FIXTURE

PLOT # 19

AETL
30
QC

ORIGINAL PAGE IS
OF POOR QUALITY

9 CUSTOMER TELEDYNE Mc CORMICK SELPH
8
7 MJO NO. 773-2612
6
5 TEST ITEM SAFETY ARMING DEVICE
4 PART NO. 816780
3 SERIAL NO. 0007
2 DATE 1-9-78
1 INPUT LEVEL 11.6 GRMS 11.4
ACCELEROMETER NO. 1
AXIS Y
LOCATION ON FIXTURE



Plot # 20

CUSTOMER TELEDYNE Mc CORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY + ARMING DEVICE

PART NO. 816780

SERIAL NO. 0016

DATE 1-9-78

INPUT LEVEL 11.6 GRMS 11.4

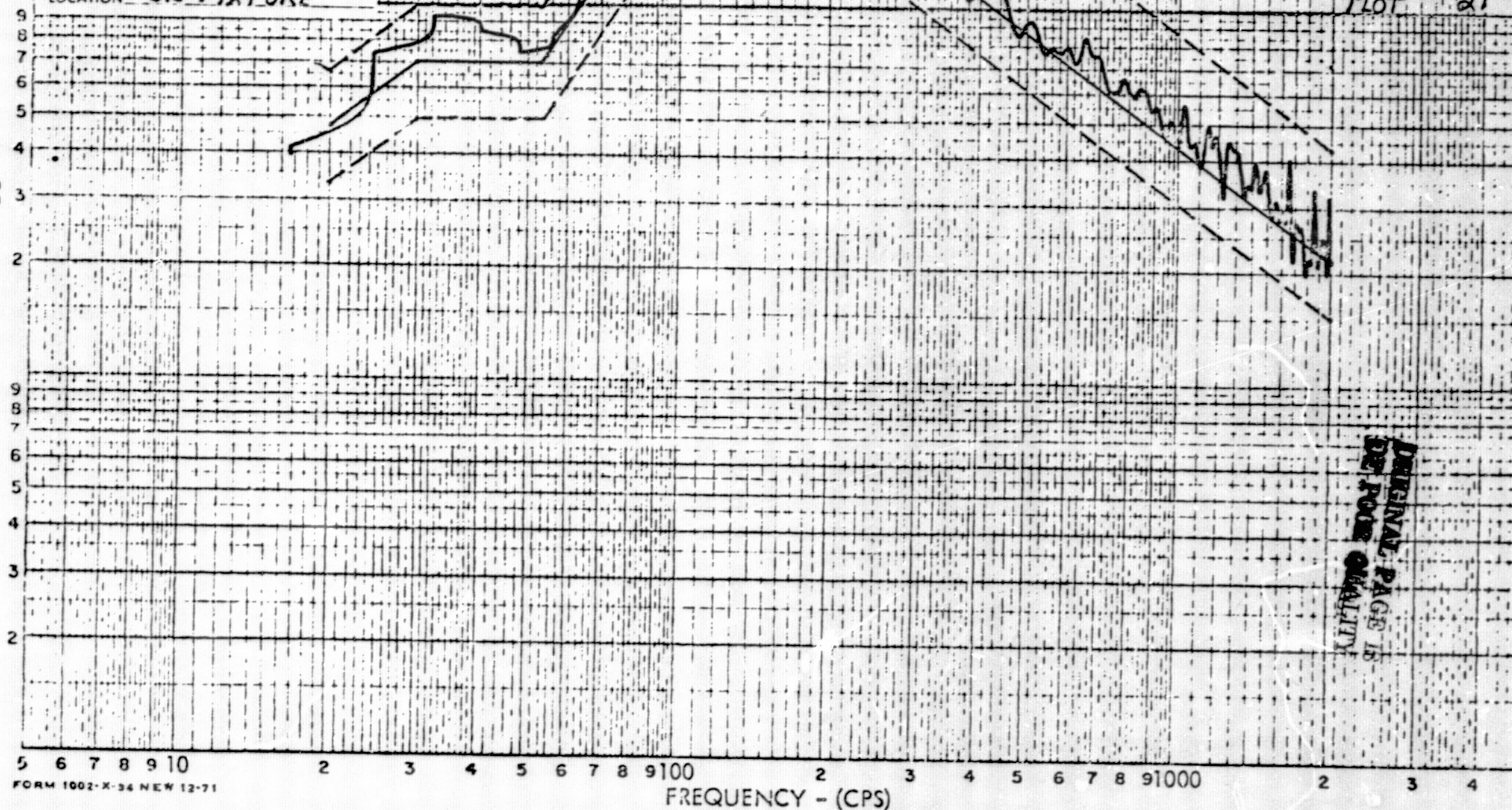
ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE

PLOT # 21

1
25
1



ORIGINAL PAGE IS
OF POOR QUALITY

CUSTOMER TELEDYNE Mc CORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY ARMING DEVICE

PART NO. 816780

SERIAL NO. 0014

DATE 1-9-78

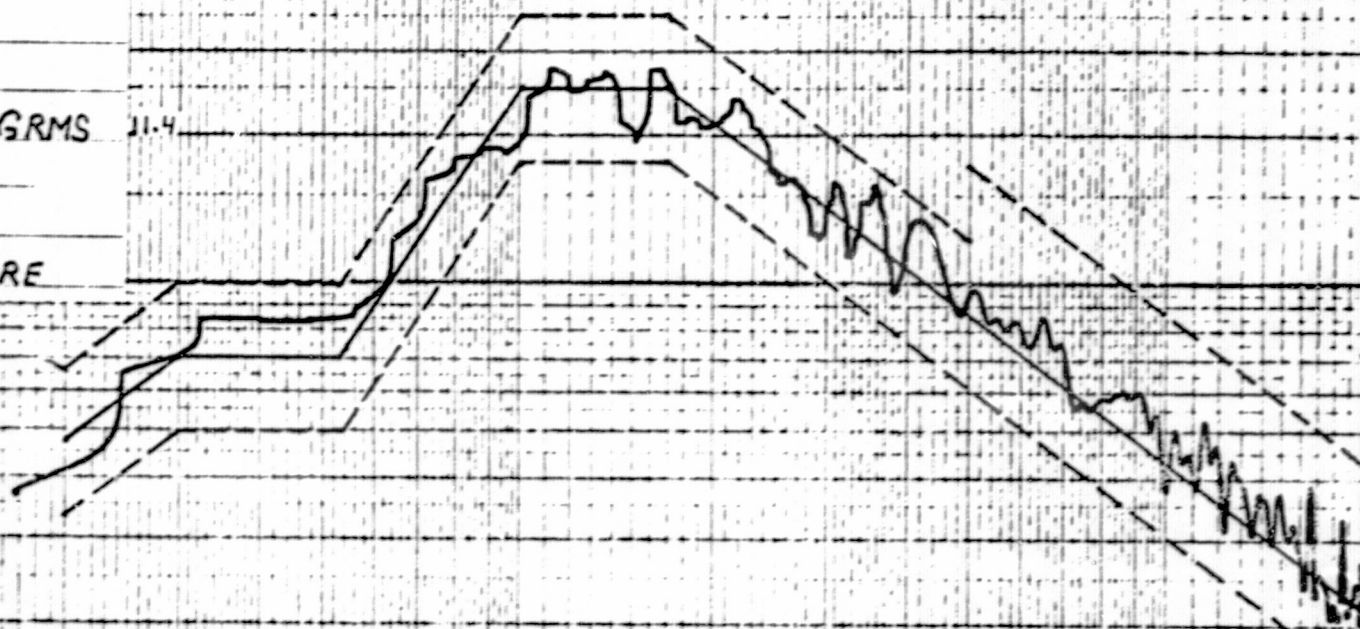
INPUT LEVEL 11.6 GRMS 11.4

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE

PLOT # 22



5 6 7 8 9 10

2 3 4 5 6 7 8 9 100 2 3 4 5 6 7 8 9 100 2 3 4

FREQUENCY - (CPS)

CUSTOMER *TELEDYNE Mc CORMICK SELPH*

MJO NO *773-2612*

TEST ITEM *SAFETY ARMING DEVICE*

PART NO *816780*

SERIAL NO *0013*

DATE *1-9-78*

INPUT LEVEL *11.6 GRMS* 11.4

ACCELEROMETER NO. *1*

AXIS *Y*

LOCATION *ON FIXTURE*



PLOT # *23*

ORIGINAL PAGE IS
OF POOR QUALITY

CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY+ARMING DEVICE

PART NO. 816780

SERIAL NO. 0019

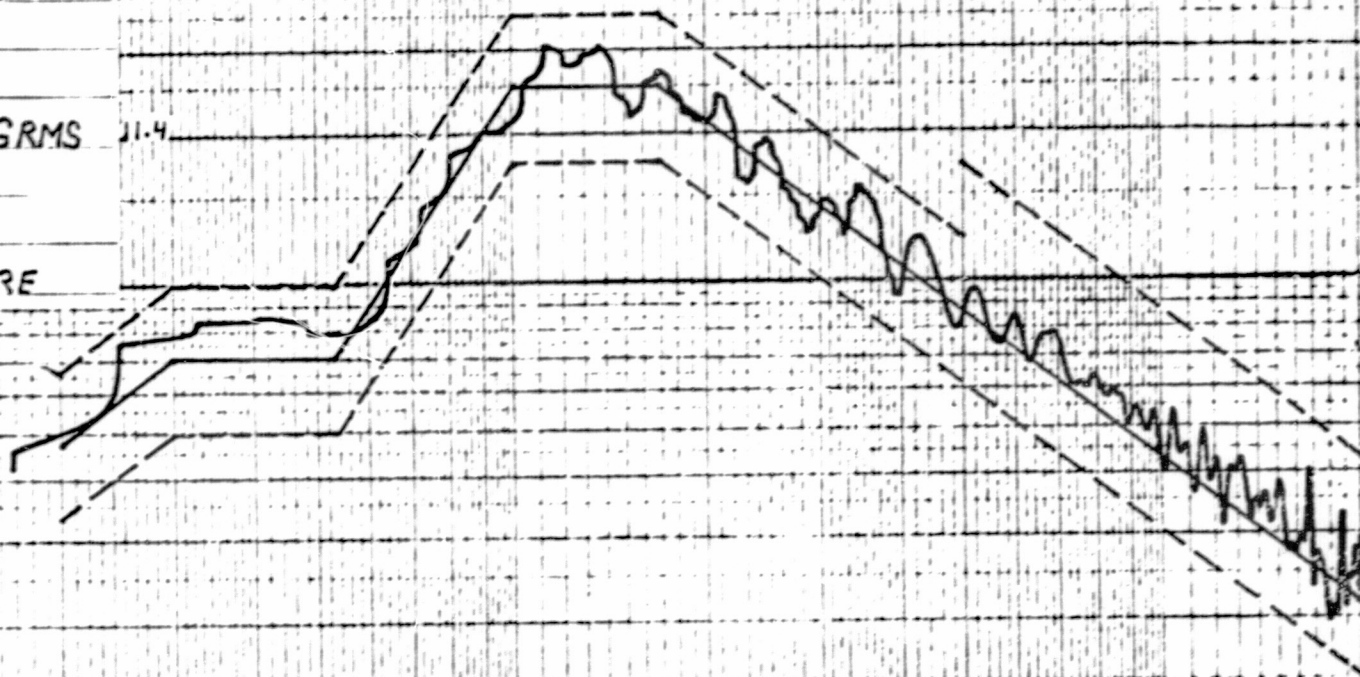
DATE 1-9-78

INPUT LEVEL 11.6 GRMS 11.4

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE



PLOT # 24

CUSTOMER TELEDYNE Mc CORMICK SELPH

MJO NO. 753-2612

TEST ITEM SAFETY ARMING DEVICE

PART NO. 816780

SERIAL NO. 0012

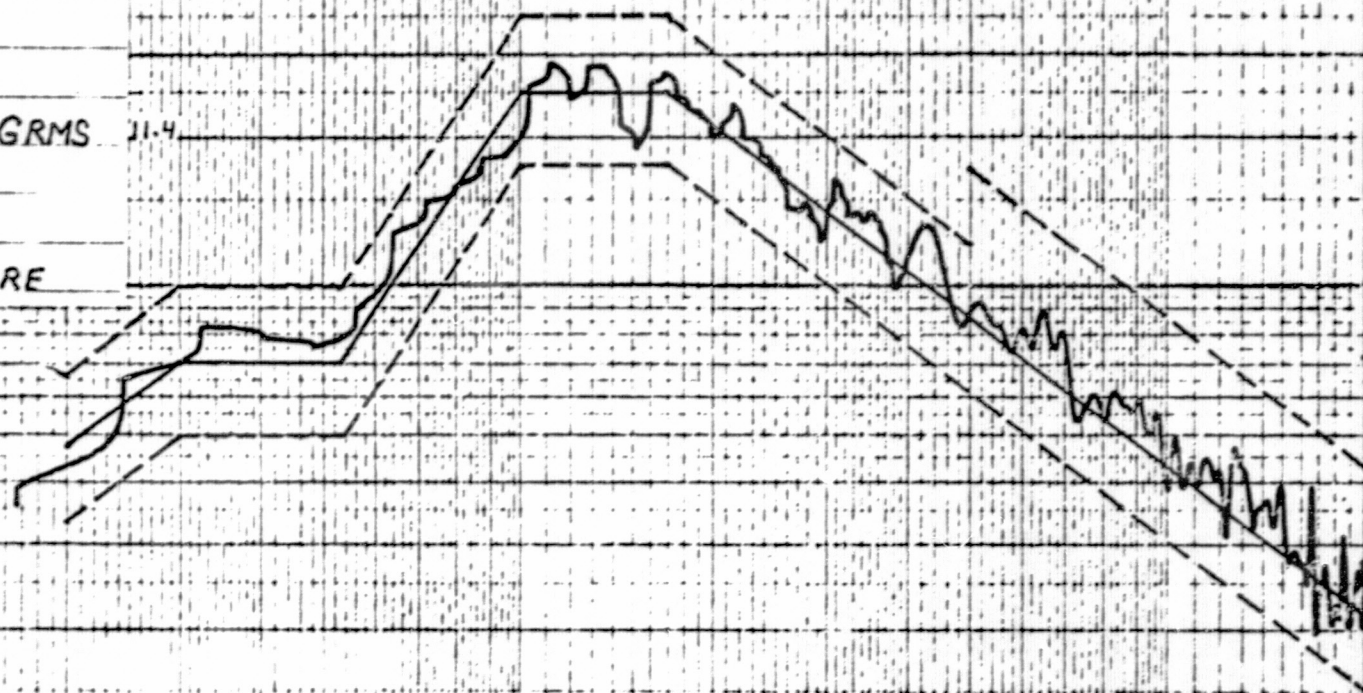
DATE 1-9-78

INPUT LEVEL 11.6 GRMS 11.4

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE



PLOT # 25

INTERNAL PAGE IS
NOT FOR QUALITY

CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY & ARMING DEVICE

PART NO. 816780

SERIAL NO. 0020

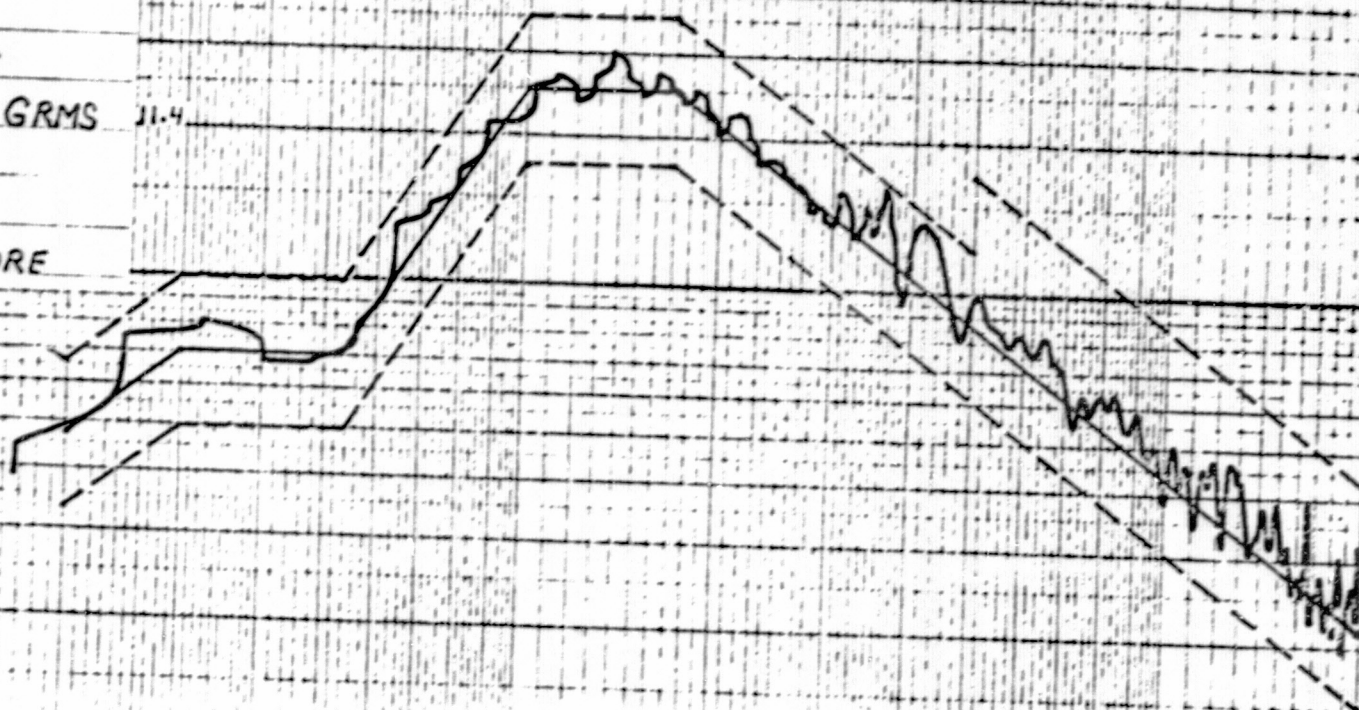
DATE 1-9-78

INPUT LEVEL 11.6 GRMS 11.4

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE



CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY ARMING DEVICE

PART NO. 816780

SERIAL NO. 0008

DATE 1-9-78

INPUT LEVEL 11.6 GRMS

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE

11.4

PLOT # 27

ORIGINAL PAGE IS
OF POOR QUALITY

FREQUENCY - (CPS)

5 6 7 8 9 10

FORM 1002-X-34 NEW 12-71

CUSTOMER TELEDYNE Mc CORMICK SELPH

MJO NO. 773-2612

TEST ITEM: SAFETY ARMING DEVICE

PART NO. 816780

SERIAL NO. 0005

DATE 1-9-79

INPUT LEVEL 11.6 GRMS 11.4

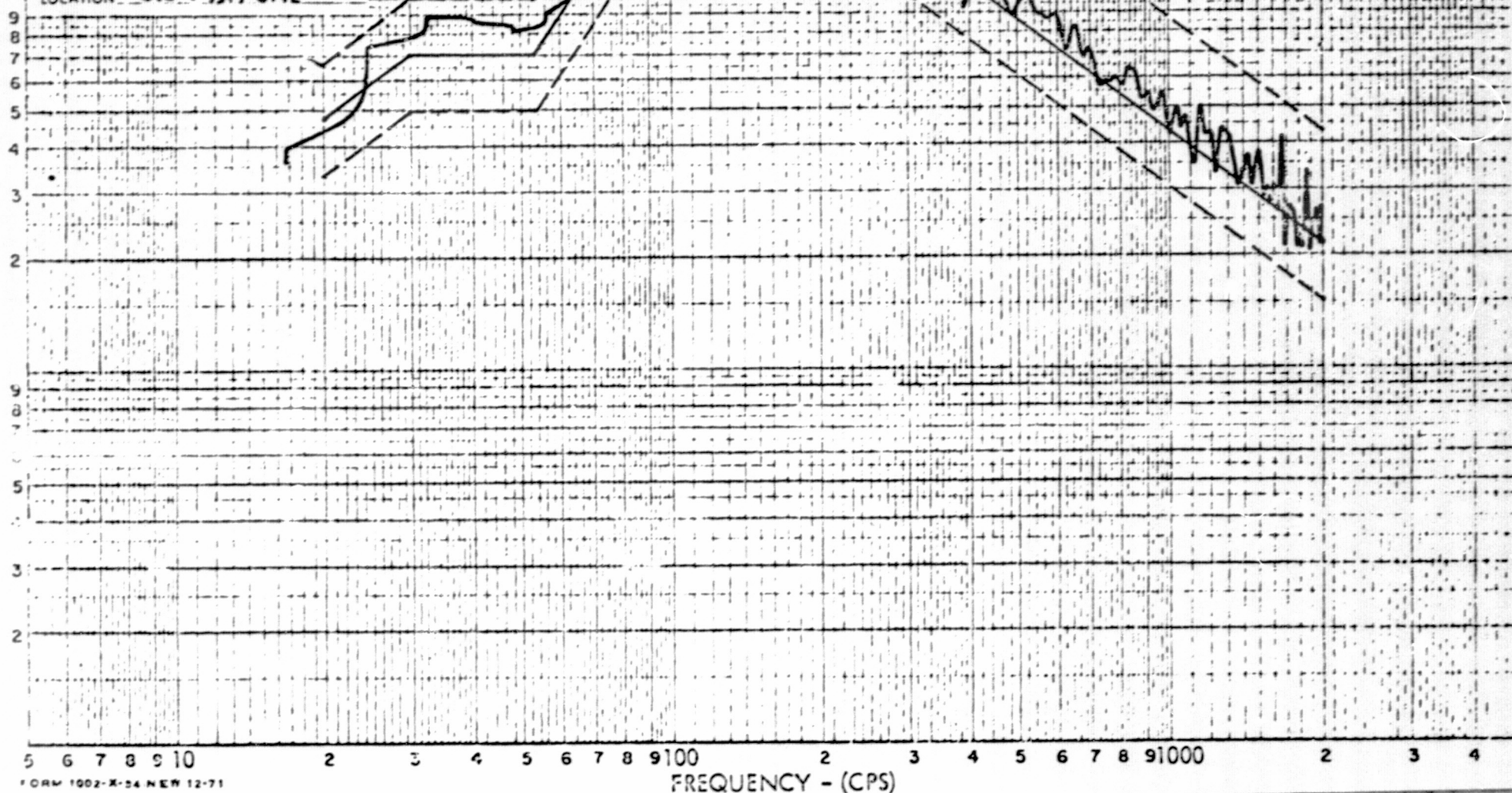
ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE

PLOT # 28

- 32 -



CUSTOMER TELEDYNE Mc CORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY+ARMING DEVICE

PART NO. 816780

SERIAL NO. 0006

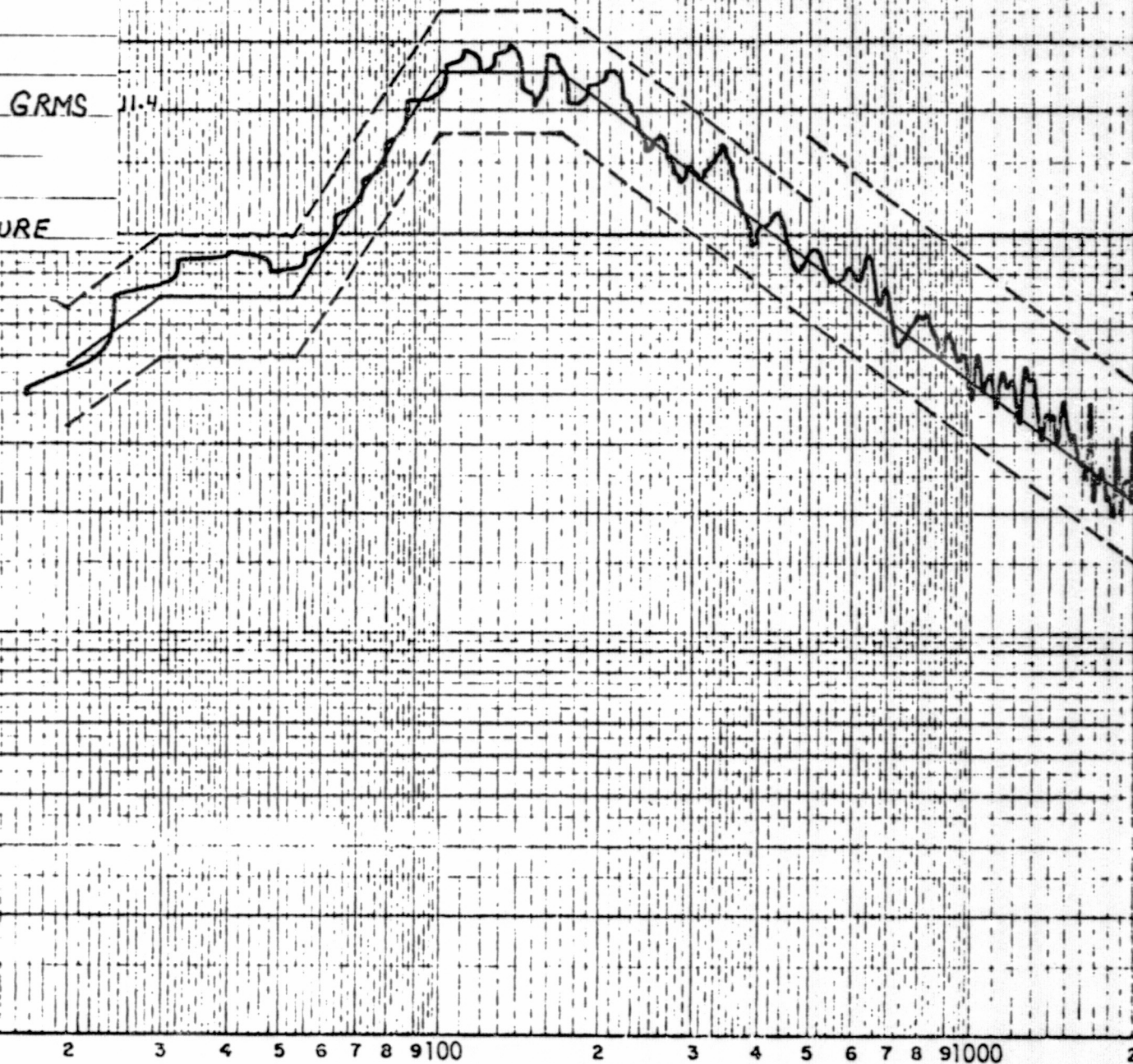
DATE 1-9-78

INPUT LEVEL 11.6 GRMS 11.4

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE



Plot # 29

ORIGINAL PAGE IS
OF POOR QUALITY

CUSTOMER TELEDYNE Mc CORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY & ARMING DEVICE

PART NO. 816780

SERIAL NO. 0017

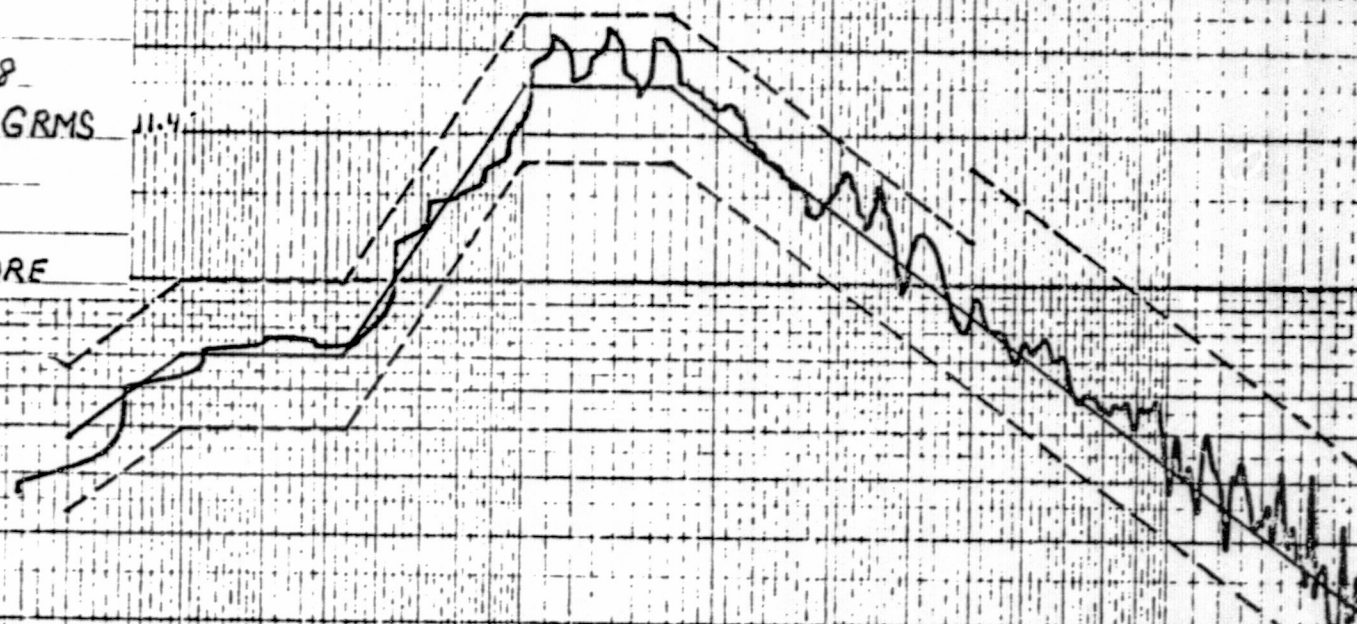
DATE 1-9-78

INPUT LEVEL 11.6 GRMS

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE



CUSTOMER TELEDYNE Mc CORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY ARMING DEVICE

PART NO. 816780

SERIAL NO. 0011

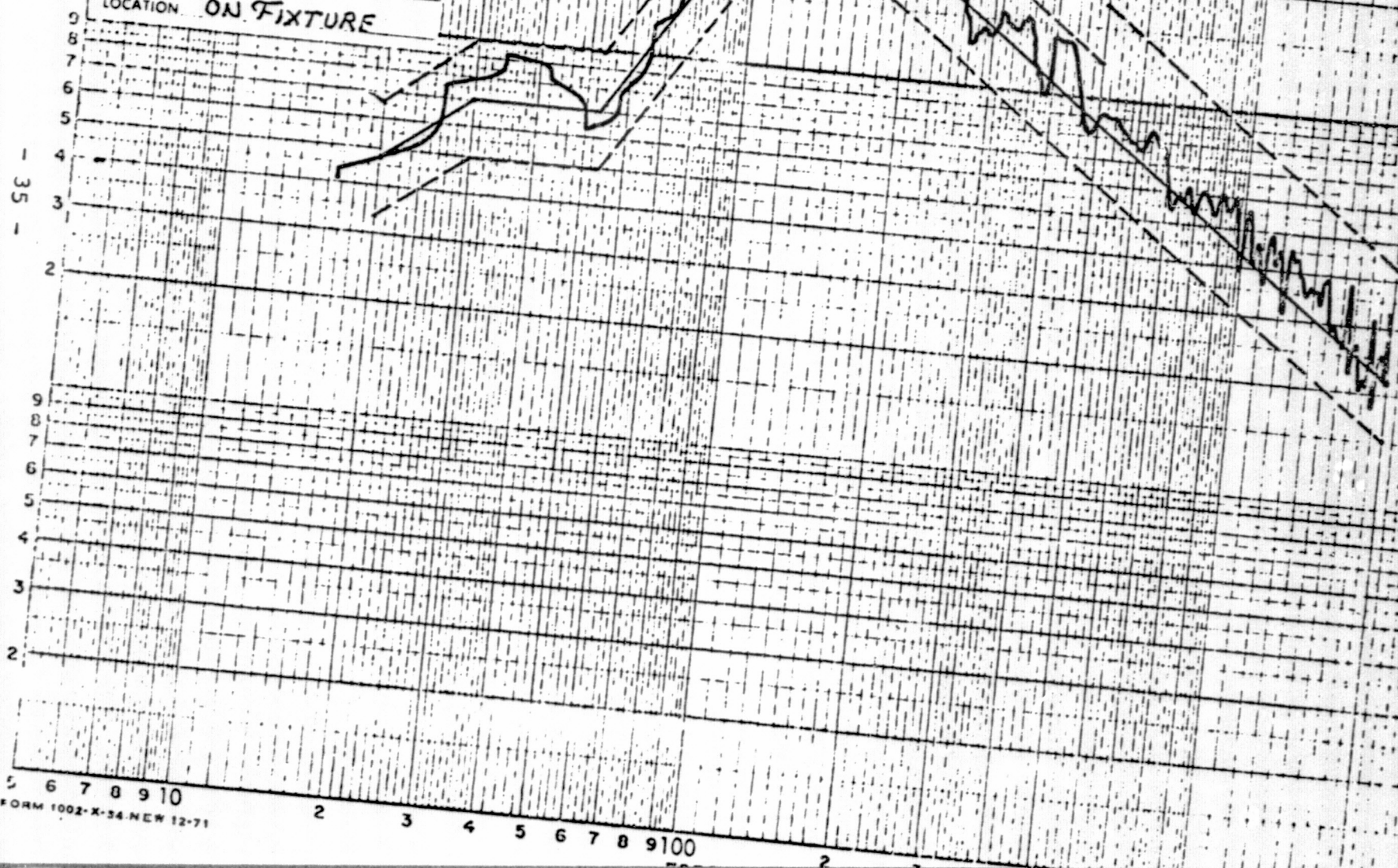
DATE 1-9-78

INPUT LEVEL 11.6 GRMS 11.4

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE



PLOT # 31

ORIGINAL PAGE IS
OF POOR QUALITY

CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY ARMING DEVICE

PART NO. 816780

SERIAL NO. 0010

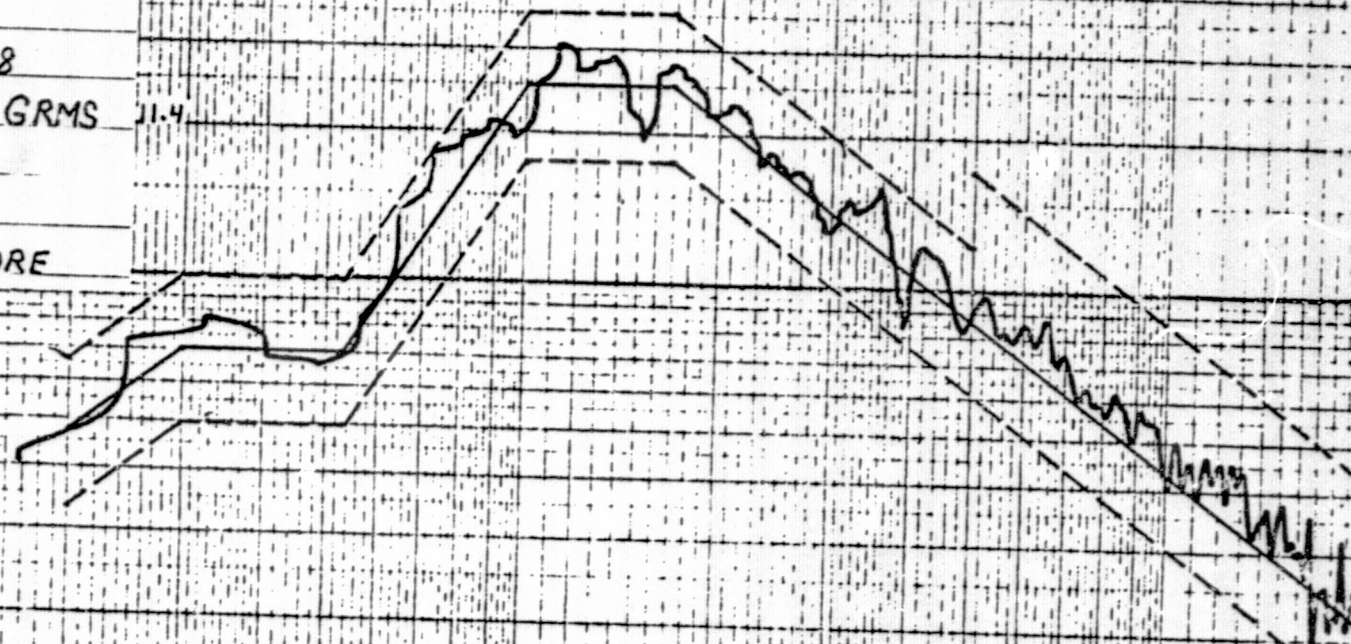
DATE 1-9-78

INPUT LEVEL 11.6 GRMS 11.4

ACCELEROMETER NO. 1

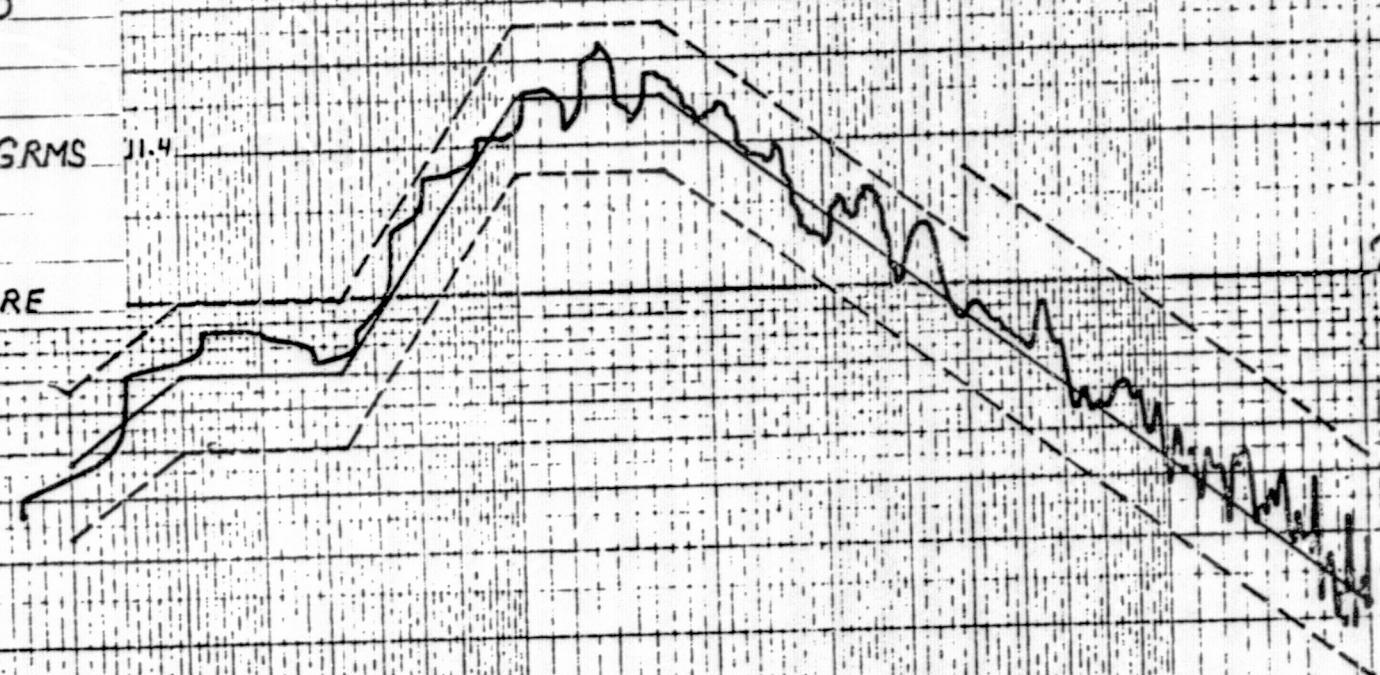
AXIS Y

LOCATION ON FIXTURE



ORIGINAL PAGE IS
OF POOR QUALITY

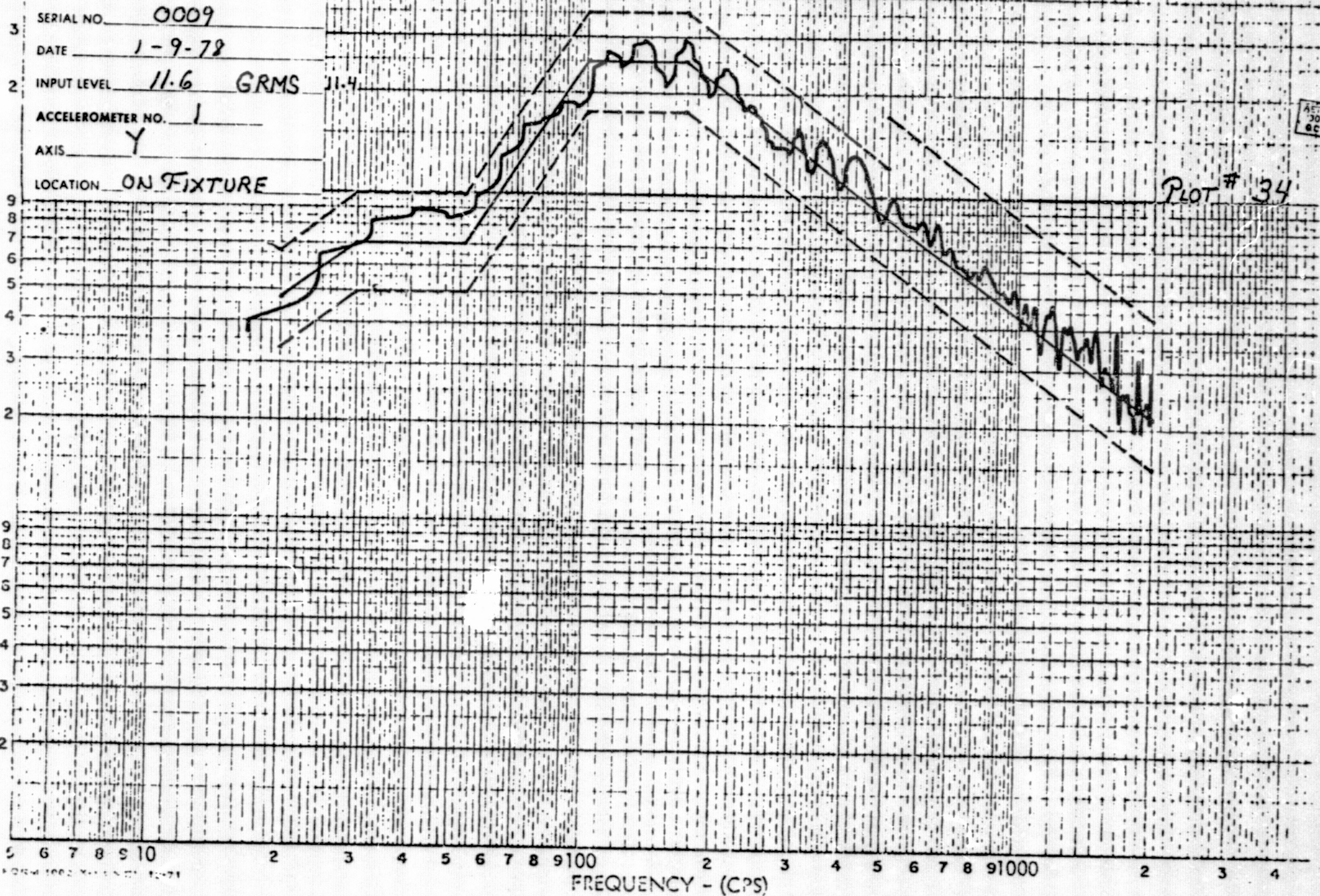
9
3
7
6
5
4
3
2
1
CUSTOMER TELEDYNE Mc CORMICK SELPH
MJO NO. 773-2612
TEST ITEM SAFETY & ARMING DEVICE
PART NO. 816780
SERIAL NO. 0018
DATE 1-9-78
INPUT LEVEL 11.6 GRMS 11.4
ACCELEROMETER NO. 1
AXIS Y
LOCATION ON FIXTURE



PLOT # 33

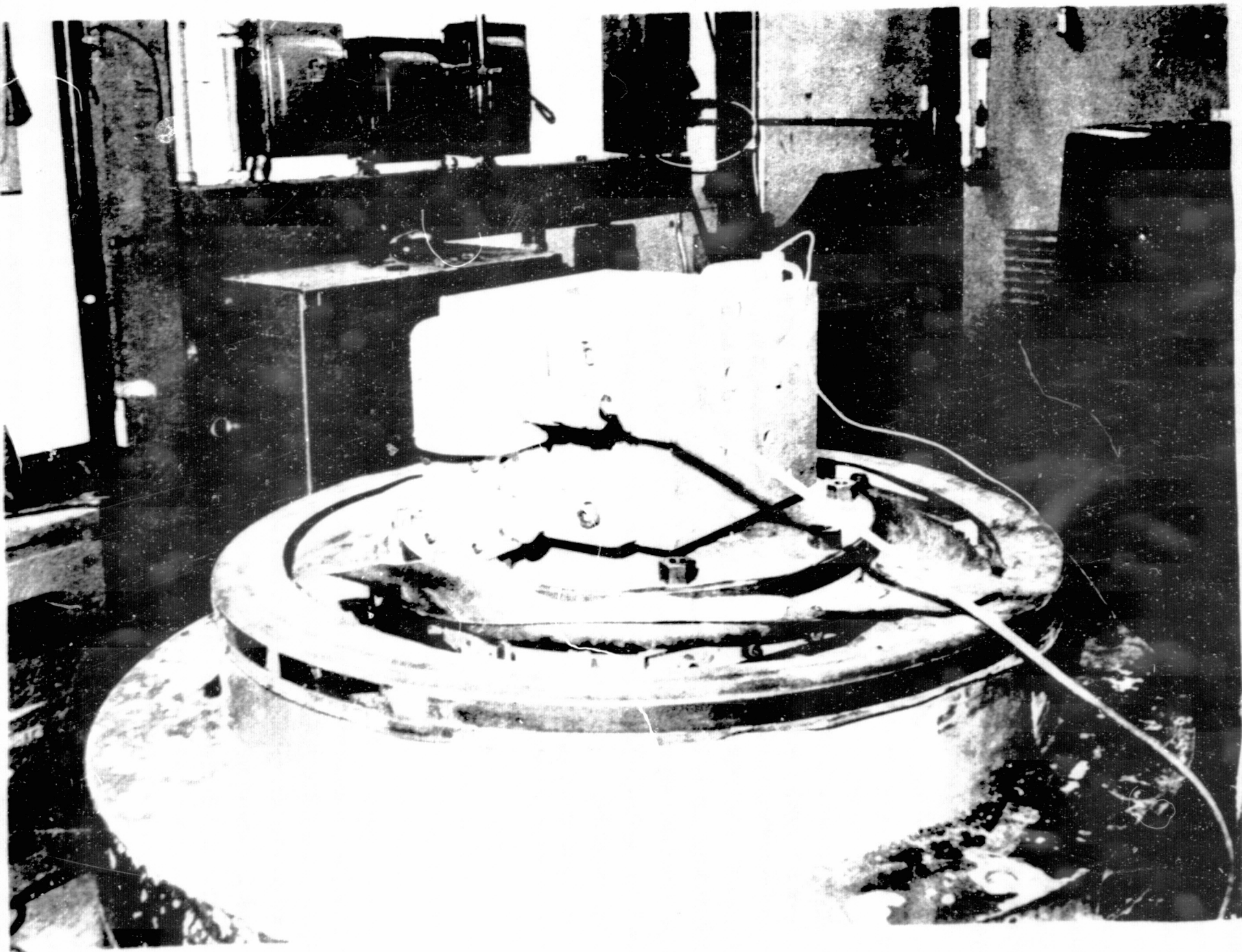
ORIGINAL PAGE IS
OF POOR QUALITY

9 CUSTOMER TELEDYNE McCORMICK SELPH
7 MJO NO. 773-2612
5 TEST ITEM SAFETY ARMING DEVICE
4 PART NO. 816780
3 SERIAL NO. 0009
2 DATE 1-9-78
INPUT LEVEL 11.6 GRMS 11.4
ACCELEROMETER NO. 1
AXIS Y
LOCATION ON FIXTURE



EQUIPMENT LIST

<u>Description</u>	<u>Apparatus</u>	<u>Calibration</u>
<u>RANDOM VIBRATION</u>	Minerva Stop Watch, AETL Control No. G-4121-F	12 months Due 10-25-78
	Ling ASDE-80 Equalizer-Analyzer, AETL Control No. D-4085-F	6 months Due 2-18-78
	Endevco Accelerometer, Model 2242, AETL Control No. D-4085-F	12 months Due 1-16-78
	Ling Accel. Normalizing Ampli- fier, Model ANA-100, AETL Control No. D-4003-F	6 months Due 7-5-78
	Ballantine RMS Meter, Model 320, AETL Control No. D-4129-F	6 months Due 4-24-78
	Spectral Dynamics Real Time Analyzer, Model SD330, AETL Control No. D-4125-F	6 months Due 2-19-78
	Esterline-Angus X-Y Recorder, Model 575, AETL Control No. D-4126-F	6 months Due 2-9-78
	Ling Vibration Exciter, Model A300, AETL Control No. D-4001-F	Not Required
	Ling Vibration Amplifier, Model PP20/20, AETL Control No. D-4000-F	Not Required
	Snap-On Torque Wrench Model 0-50" lbs., AETL Control No. G-4136-F	12 months Due 11-23-78



ORIGINAL PAGE IS
OF POOR QUALITY

APPENDIX C
RETEST DATA SHEETS
(26 PAGES)

TEST SUMMARY SHEET

JOB NUMBER 4918-78-239 REPORT NUMBER 4918-239 TMC/S PART NUMBER 816780-3 REV. E

CUSTOMER SPECIFICATION 10A00455 E TMC/S PROCEDURE ATP 816780 REV. B DATE TEST COMPLETED 27 FEBRUARY 1978

TYPE OF TEST	② REFERENCE PARAGRAPH	MEASURED VALUES		NUMBER OF UNITS		REMARKS AND/OR UNTOWARD INCIDENTS
		MINIMUM	MAXIMUM	TESTED	ACCEPTED	
EXAMINATION	5.1	N/A	N/A	7	7	NONE
X-RAY	5.2	N/A	N/A	7	7	NONE
N-RAY	5.3	N/A	N/A	7	7	NONE
VIBRATION	5.4	20 Hz 8.7 grms -----	2000 Hz 11.4 grms 1 min/axis	7	7	NONE
LEAK	5.5	61Kft 2 Min.	----- -----	7	7	NONE
TEMP. ELECT. CYCLING	5.6	24 VDC +20°F	32 VDC +165°F	7	7	NONE
AMBIENT ELECTRICAL CHECK-OUT	5.7	500 VDC 100 MEGOHMS	--- ---	7	7	NONE

Reference paragraphs ① Customer Specification ② TMC/S Procedure

WATER IMMERSION TEST

PRECEDING TEST VIBRATION

VACUUM LEVEL 28 IN. Hg.

TMc/S PART NUMBER 816780-3 REV. E

SUCCEEDING TEST TEMP. ELECT.
CYCLING

TIME DURATION 2.0 MIN.

RESULTS:

AMBIENT TEMP. °F

[illegible]

WITNESSED BY: B. Purinton

TESTED BY: K. Hane



TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

DATE 24 FEBRUARY 1978

W. O. NUMBER 239

TMc/S DWG. NUMBER 816780 REV. E

TMC/S PROCEDURE ATP 816780 REV. B

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

TEST TEMP. +165°F

[illegible]

WITNESS

VALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.

TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 9502

TEST DATA SHEET

FOR

(PERATIONAL (90° ROTATION)

ORIGINAL PAGE IS
OF POOR QUALITY

REPORT NUMBER 4918-239

DATE 24 FEBRUARY 1978

JOB NUMBER 4918-69

W. O. NUMBER 239

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2, 3, 4, 5, 6, 7 & 13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 4

SERIAL NO. 0013

TEST TEMP. +165°F

TMC/S PART NUMBER 816780-3 REV. E

[illegible]

F. Horibe

TECHNICIAN

B. Purinton

WITNESS

VALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

ORIGINAL PAGE IS
OF POOR QUALITY

REPORT NUMBER 4918-239

DATE 24 FEBRUARY 1978

JOB NUMBER 4918-19

W. O. NUMBER 239

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2, 3, 4, 5, 6, 7 & 13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 6

SERIAL NO. 0019

TEST TEMP. +165°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

F. Horibe
TECHNICIAN

B. Purinton
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-239

DATE 24 FEBRUARY 1978

JOS NUMBER 4918-69

W. O. NUMBER 239

TMc/S PART NAME SAFETY & ARMING DEVICE

Mc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

JMc/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2, 3, 4, 5, 6, 7 & 13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 7

SERIAL NO. 0020

TEST TEMP. +165°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

F. Horibe

TECHNICIAN

B. Purinton

WITNESS

- EVALUATION OF TEST RESULTS (CHECK ONE)

☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-239

DATE 24 FEBRUARY 1978

JOB NUMBER 4918-69

W. O. NUMBER 239

TMC/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2, 3, 4, 5, 6, 7 & 13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 2 SERIAL NO. 0009 TEST TEMP. AMB.

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

F. Horibe
TECHNICIAN

B. Purinton
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-239

DATE 24 FEBRUARY 1978

JOB NUMBER 4918-69

W. O. NUMBER 239

TMG/S PART NAME SAFETY & ARMING DEVICE

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S **PROCEDURE** ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2, 3, 4, 5, 6, 7 & 13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 3

SERIAL NO. 0011

TEST TEMP. AMB.

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

F. Horibe

TECHNICIAN

B. Purinton

WITNESS

VALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-239

DATE 24 FEBRUARY 1978

JOB NUMBER 4918-69

W. O. NUMBER 239

TMc/S	PART NAME	SAFETY & ARMING DEVICE
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9
10	10	10
11	11	11
12	12	12
13	13	13
14	14	14
15	15	15
16	16	16
17	17	17
18	18	18
19	19	19
20	20	20
21	21	21
22	22	22
23	23	23
24	24	24
25	25	25
26	26	26
27	27	27
28	28	28
29	29	29
30	30	30
31	31	31
32	32	32
33	33	33
34	34	34
35	35	35
36	36	36
37	37	37
38	38	38
39	39	39
40	40	40
41	41	41
42	42	42
43	43	43
44	44	44
45	45	45
46	46	46
47	47	47
48	48	48
49	49	49
50	50	50
51	51	51
52	52	52
53	53	53
54	54	54
55	55	55
56	56	56
57	57	57
58	58	58
59	59	59
60	60	60
61	61	61
62	62	62
63	63	63
64	64	64
65	65	65
66	66	66
67	67	67
68	68	68
69	69	69
70	70	70
71	71	71
72	72	72
73	73	73
74	74	74
75	75	75
76	76	76
77	77	77
78	78	78
79	79	79
80	80	80
81	81	81
82	82	82
83	83	83
84	84	84
85	85	85
86	86	86
87	87	87
88	88	88
89	89	89
90	90	90
91	91	91
92	92	92
93	93	93
94	94	94
95	95	95
96	96	96
97	97	97
98	98	98
99	99	99
100	100	100

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2, 3, 4, 5, 6, 7 & 13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 4

SERIAL NO. 0013

TEST TEMP. AMB.

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

F. Horibe

TECHNICIAN

B. Purinton

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

☒ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

ORIGINAL PAGE IS
OF POOR QUALITY

REPORT NUMBER 4918-239

DATE 24 FEBRUARY 1978

JOB NUMBER 4918-69

W. O. NUMBER 239

TMC/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS. 2, 3, 4, 5, 6, 7 & 13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 5 SERIAL NO. 0017 TEST TEMP. AMB.

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

F. Horibe
TECHNICIAN

B. Purinton
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.

TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-239

DATE 24 FEBRUARY 1978

JOB NUMBER 4918-69

W. O. NUMBER 239

TMC/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

~~CUSTOMER SPECIFICATION~~ NASA 10A 00465

TMc/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2, 3, 4, 5, 6, 7 & 13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 6

SERIAL NO. 0019

TEST TEMP. AMB.

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

F. Horibe

TECHNICIAN

B. Purinton

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

ORIGINAL PAGE IS
OF POOR QUALITY

REPORT NUMBER 4918-239

DATE 24 FEBRUARY 1978

JOB NUMBER _____ 4918-69

W. O. NUMBER 239

TTC/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2, 3, 4, 5, 6, 7 & 13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 7

SERIAL NO. 0020

TEST TEMP. AMB.

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

F. Horibe

TECHNICIAN

B. Purinton

WITNESS

- VALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S

TEST DATA SHEET
FOR
(OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-239

DATE 2/24/78

JOB NUMBER 4918-69

W. O. NUMBER 239

7Mc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2,3,4,5,6,7,13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 1

SERIAL NO. 0005

TEST TEMP. +20°F

TMC/S PART NUMBER 816780-3 REV. E

[illegible]

F. HORIBE

TECHNICIAN

B. PURINTON

WITNESS

VALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S

ORIGINAL PAGE IS
OF POOR QUALITY

TEST DATA SHEET
FOR
(OPERATIONAL (90° ROTATION))

REPORT NUMBER 4918-239

DATE 2/24/78

JOB NUMBER 4918-69

W.O. NUMBER 239

7Mc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2,3,4,5,6,7,13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 2

SERIAL NO. 0009

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

F. HORIBE

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.

TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

ORIGINAL PAGE IS
OF POOR QUALITY

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-239

DATE 2/24/78

JOB NUMBER 4918-69

W. O. NUMBER 239

TMG/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2,3,4,5,6,7,13

REQUIREMENTS. ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 4

SERIAL NO. 0013

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

F. HORIBE

TECHNICIAN

B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.

TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-239

DATE 2/24/78

JOB NUMBER 4918-69

W.O. NUMBER 239

7Mc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2,3,4,5,6,7,13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 5

SERIAL NO. 0017

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-3 REV. E

[illegible]

F. HORIBE

TECHNICIAN

B. PURINTON

WITNESS

VALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S



ORIGINAL PAGE IS
OF POOR QUALITY

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER 4918-239

DATE 2/24/78

JOB NUMBER 4918-69

W. O. NUMBER 239

7Mc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS 2,3,4,5,6,7,13

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. 6

SERIAL NO. 0019

TEST TEMP. +20°F

TMc/S PART NUMBER 816780-3 REV. E

F. HORIBE

TECHNICIAN

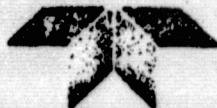
B. PURINTON

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

E DISCREPANCY/S NOTED OF UNIT/S



TELEDYNE MCCORMICK SELPH

HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
CIRCUITRY CHECKS

REPORT NUMBER 4918-239

DATE 27 FEBRUARY 1978

JOB NUMBER 4918-69

W.O. NUMBER 239

TMC/S PART NAME SAFETY & ARMING DEVICE

TMC/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

REQUIREMENTS: SAFE POSITION

ARMED POSITION

A) G-H, K-N, P-R & S-T PIN TO PIN VOLTAGE
SHALL BE LESS THAN 750 MILLIVOLTS @
2.5 AMPERES

A) J-H, K-L, R-N, & T-U PIN TO PIN VOLTAGE
SHALL BE LESS THAN 750 MILLIVOLTS @ 2.5
AMPERES.

B) J-H, K-L, R-N & T-U PIN TO PIN SHOULD
INDICATE AN OPEN CIRCUIT.

B) G-H, K-N, P-R & S-T PIN TO PIN SHOULD

C) SOLENOID RESISTANCE SHALL BE 0.52-
11.72 ohms

INDICATE AN OPEN CIRCUIT.

TARE VOLTAGE = .500 V.

UNIT S/N	①	RECORD VOLTAGE READING OR WRITE OPEN IN EACH COLUMN BELOW										SOLENOID
		G-H	K-N	P-R	S-T	J-H	K-L	R-N	T-U	F-M	V-CASE	OHMS
0005	S	.250	.350	.220	.360	OPEN	OPEN	OPEN	OPEN	.160	.240	11.20
	A	OPEN	OPEN	OPEN	OPEN	.160	.290	.240	.240	.160	.320	
0009	S	.220	.220	.240	.360	OPEN	OPEN	OPEN	OPEN	.160	.240	11.25
	A	OPEN	OPEN	OPEN	OPEN	.140	.240	.220	.220	.170	.270	
0011	S	.200	.270	.200	.240	OPEN	OPEN	OPEN	OPEN	.140	.170	11.18
	A	OPEN	OPEN	OPEN	OPEN	.180	.270	.220	.170	.160	.220	
0013	S	.220	.200	.250	.380	OPEN	OPEN	OPEN	OPEN	.120	.320	11.20
	A	OPEN	OPEN	OPEN	OPEN	.180	.200	.210	.240	.120	.320	
0017	S	.240	.200	.200	.280	OPEN	OPEN	OPEN	OPEN	.120	.300	11.20
	A	OPEN	OPEN	OPEN	OPEN	.160	.240	.220	.160	.120	.310	
0019	S	.280	.220	.190	.320	OPEN	OPEN	OPEN	OPEN	.150	.260	11.20
	A	OPEN	OPEN	OPEN	OPEN	.160	.180	.200	.180	.150	.330	
0020	S	.220	.220	.200	.300	OPEN	OPEN	OPEN	OPEN	.160	.300	11.29
	A	OPEN	OPEN	OPEN	OPEN	.200	.200	.200	.160	.180	.320	

① UNIT POSITION S = SAFE A = ARM

F. Horibe
TECHNICIAN

B. Purinton
WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

X ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S



ORIGINAL PAGE IS
OF POOR QUALITY

TEST DATA SHEET
FOR
INSULATION RESISTANCE

REPORT NUMBER 4918-239

DATE 27 FEBRUARY 1978

JO# NUMBER 4918-69

W.O. NUMBER 239

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS _____ 15

REQUIREMENTS WITH THE ROTOR IN THE SAFE POSITION, THE INSULATION RESISTANCE BETWEEN CURRENT CARRYING PARTS AND THE CASE SHALL BE GREATER THAN 100 MEGOHMS AT 500 VDC.

PRECEDING PAGE BLANK NOT FILMED

F. Horibe

TECHNICIAN

B. Purinton

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

8 ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.



**TEST DATA SHEET
FOR
CONTINUITY TEST**

REPORT NUMBER 4918-239

DATE 27 FEBRUARY 1978

JOB NUMBER 4918-69

W. O. NUMBER 239

THE/S PART NAME SAFETY AND ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. E

CUSTOMER SPECIFICATION NASA 10A00465 REV. C

TMC/S PROCEDURE ATP 816780 REV. B

TEST EQUIPMENT ITEM NUMBERS. 14

REQUIREMENTS _____ VERIFY THAT AN OPEN CIRCUIT EXISTS AS NOTED BELOW

CUSTOMER PART NUMBER NASA 1CA00465 REV. C

[illegible]

F. Horibe

TECHNICIAN

B. Purinton

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

2 ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

☐ DISCREPANCY/S NOTED OF UNIT/S.

APPENDIX D

APPROVED ENGINEERING TEST LABORATORIES

TEST REPORT NUMBER 773-2612-2

(21 PAGES)



APPROVED ENGINEERING TEST LABORATORIES / 1536 EAST VALENCIA / FULLERTON, CALIFORNIA 92631 / TEL. (714) 879-6110
A NATIONAL TECHNICAL SERVICES COMPANY

17 February 1978

FULLERTON DIVISION REPORT NUMBER 773-2612-2
Teledyne McCormick Selph P. O. Number 96064RR, C/O 2

- A. TEST: Acceptance Random Vibration
- B. TEST ITEMS: Seven (7) Safety and Arming Devices,
Tmc/S P/N 816780, S/N's 0005, 0009, 0011, 0013,
0017, 0019, and 0020.
- C. SPECIFICATION: Tmc/S Acceptance Test Procedure No.
ATP 816780, Revision B, paragraph 5.4.

- D. RESULTS: This is to certify that the test items were
subjected to the Acceptance Random Vibration
Test according to the above specification.

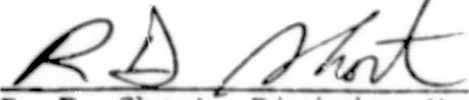
Each S&A was attached to the test fixture with
a bolt torque of 42 inch-pounds, and was set in
the ARMED position.

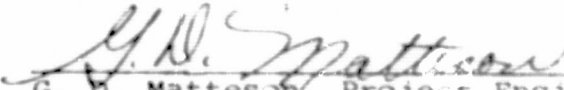
The position of the S&A was monitored during
the vibration, and after each axis the S&A was
switched from SAFE to ARMED to SAFE and checked
for elapsed time by a Tmc/S representative, with
the use of Tmc/S equipment.

There was no visible evidence of damage result-
ing from the vibration. The test items were
returned to Tmc/S for post-tests and final
evaluation.

Test data and an equipment list are attached.

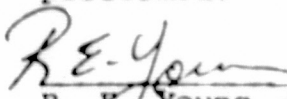
APPROVED ENGINEERING TEST LABORATORIES


R. D. Short, Division Manager


G. D. Matteson, Project Engineer


R. J. McKelligott
Quality Assurance Manager

Required POA of listed items has been
performed.


R. E. Young, Auth. Gov't Rep. 2-17-78
Contract No. NAS8-31973

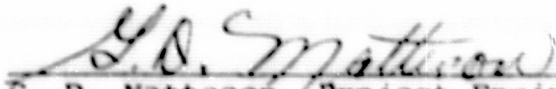
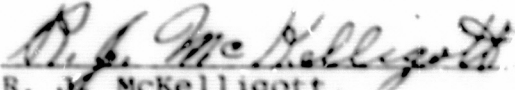
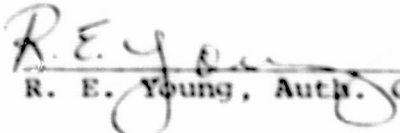


DCAS QAR

mne

Revision A

REVISIONS PAGE

Rev. A	Revised	Date
	<u>Page 3</u> - Vibration Data Sheet Time Column - Time Entries were corrected for test sequences 14 and 15, was: 1128 for Sequence 14 1128 for Sequence 15 is: 1138 for Sequence 14 1142 for Sequence 15  G. D. Matteson, Project Engineer   R. J. McKelligott, Quality Assurance Manager   R. E. Young, Auth. Gov't Rep.	3/29/78



PROVED ENGINEERING TEST LABORATORIES

A NATIONAL TECHNICAL SERVICES CO.

NTS

Date Started: 2-17-78	AETL VIBRATION TEST DATA		M.J.O.: 773-2612
Date Completed: 2-17-78	Customer: TELEDYNE McCORMICK SELPH	Test: Random	Performed By: G. W. CAYER
Specimen Description: SAFETY AND ARMING DEVICE		Specimen Part No. 816780	Test Engineer: G. MATTESON
Specification: ATP 816780 REV. B, PARA. 5.4		Witnessed By: AETL 30 6C	

Date	Time	Temperature	Frequency Bandwidth	P.S.D. Level	Roll-Up	Roll-Off	Acceleration Level	Duration	Axis	Test Sequence	Plot No.	Specimen Serial No.	Remarks
Day	Hour	°F	Hz	G ² /Hz	db/oct	db/oct	Grms	SEC	X-Y-Z	Noted	Noted	Noted	Units
2-17-78	0900	AMB	20-40	—	3	—	8.8	N/A	X+Z	1	1		FIXTURE EQUALIZATION
			40-135	.02	—	—							
			135-250	—	3	—							
			250-440	.037	—	—							
			440-500	—	9	—							
			500-1100	.055	—	—							
			1100-2000	—	—	6							
	0936		SAME AS ABOVE		8.9	60	X	2	2			0005	RANDOM RUN
	0945		SAME AS ABOVE		8.9	60	Z	3	3			0005	RANDOM RUN
	0952		SAME AS ABOVE		8.9	60	Z	4	4			0011	RANDOM RUN
	0958		SAME AS ABOVE		8.9	60	X	5	5			0011	RANDOM RUN
	1028		SAME AS ABOVE		8.9	60	X	6	6			0019	RANDOM RUN
	1033		SAME AS ABOVE		8.9	60	Z	7	7			0019	RANDOM RUN
Y	1040	Y	SAME AS ABOVE		8.9	60	Z	8	8			0017	RANDOM RUN
2-17-78	1045	AMB	SAME AS ABOVE		8.9	60	X	9	9			0017	RANDOM RUN
NOTE: SAFETY ARMING DEVICE WAS IN THE ARMED POSITION DURING VIBRATION AND SWITCH POSITION WAS MONITORED. AFTER EACH AXIS OF VIBRATION THE DEVICE WAS CYCLED FROM SAFE TO ARMED TO SAFE, AND THE ELAPSED TIME FOR 90° ROTATION DID NOT EXCEED 250 ms.													



PROVED ENGINEERING TEST LABORATORIES

A NATIONAL TECHNICAL SERVICES CO.

NTS

Date Started: 2-17-78	AETL VIBRATION TEST DATA		M.J.O.: 773-2612
Date Completed: 2-17-78	Customer: TELEDYNE McCORMICK SELPH	Test: Random	Performed By: G.W. CAYER
Specimen Description: SAFETY AND ARMING DEVICES	Specimen Part No.: 816780	Test Engineer: G. MATTESON	Witnessed By: AETL JG GC
Specification: ATP 816780 REV. B, PARA. 5.4			

Date		Time	Temperature	Frequency Bandwidth	P.S.D. Level	Roll-Up	Roll-Off	Acceleration Level	Duration	Axis	Test Sequence	Plot No.	Specimen Serial No.	Remarks
Day	Hour	°F	Hz	G ² /Hz	db/oct	db/oct	Grms	SEC.	X-Y-Z	Noted	Noted		Noted	Units
2-17-78	1115	AMB	20-30	—	3	—	11.4	N/A	Y	10	10		FIXTURE	EQUALIZATION
			30-53	.07	—	—								
			53-100	—	6	—								
			100-170	.25	—	—								
			170-200	—	—	3								
	1125		SAME AS ABOVE				11.6	60	Y	11	11		0005	RANDOM RUN
	1130		SAME AS ABOVE				11.6	60	Y	12	12		0009	RANDOM RUN
	1134		SAME AS ABOVE				11.6	60	Y	13	13		0011	RANDOM RUN
	1138		SAME AS ABOVE				11.6	60	Y	14	14		0013	RANDOM RUN
	1142		SAME AS ABOVE				11.6	60	Y	15	15		0017	RANDOM RUN
Y	1147	Y	SAME AS ABOVE				11.6	60	Y	16	16		0019	RANDOM RUN
2-17-78	1152	AMB	SAME AS ABOVE				11.6	60	Y	17	17		0020	RANDOM RUN
NOTE: SAFETY ARMING DEVICE WAS IN ARMED POSITION DURING VIBRATION AND SWITCH POSITION WAS MONITORED. AFTER EACH AXIS VIBRATION THE DEVICE WAS CYCLED FROM SAFE TO ARMED TO SAFE AND THE ELAPSED TIME FOR 90° ROTATION WAS MONITORED WITH CUSTOMER SUPPLIED TEST EQUIPMENT.														

- 3 -

Revision A

CUSTOMER **TELEDYNE McCORMICK SELPH**

MJO NO. **773-2612**

TEST ITEM **SAFETY+ARMING DEVICE**

PART NO. **816780**

SERIAL NO. **FIXTURE**

DATE **2-17-78**

INPUT LEVEL **8.8 GRMS** 8.7

ACCELEROMETER NO. **1**

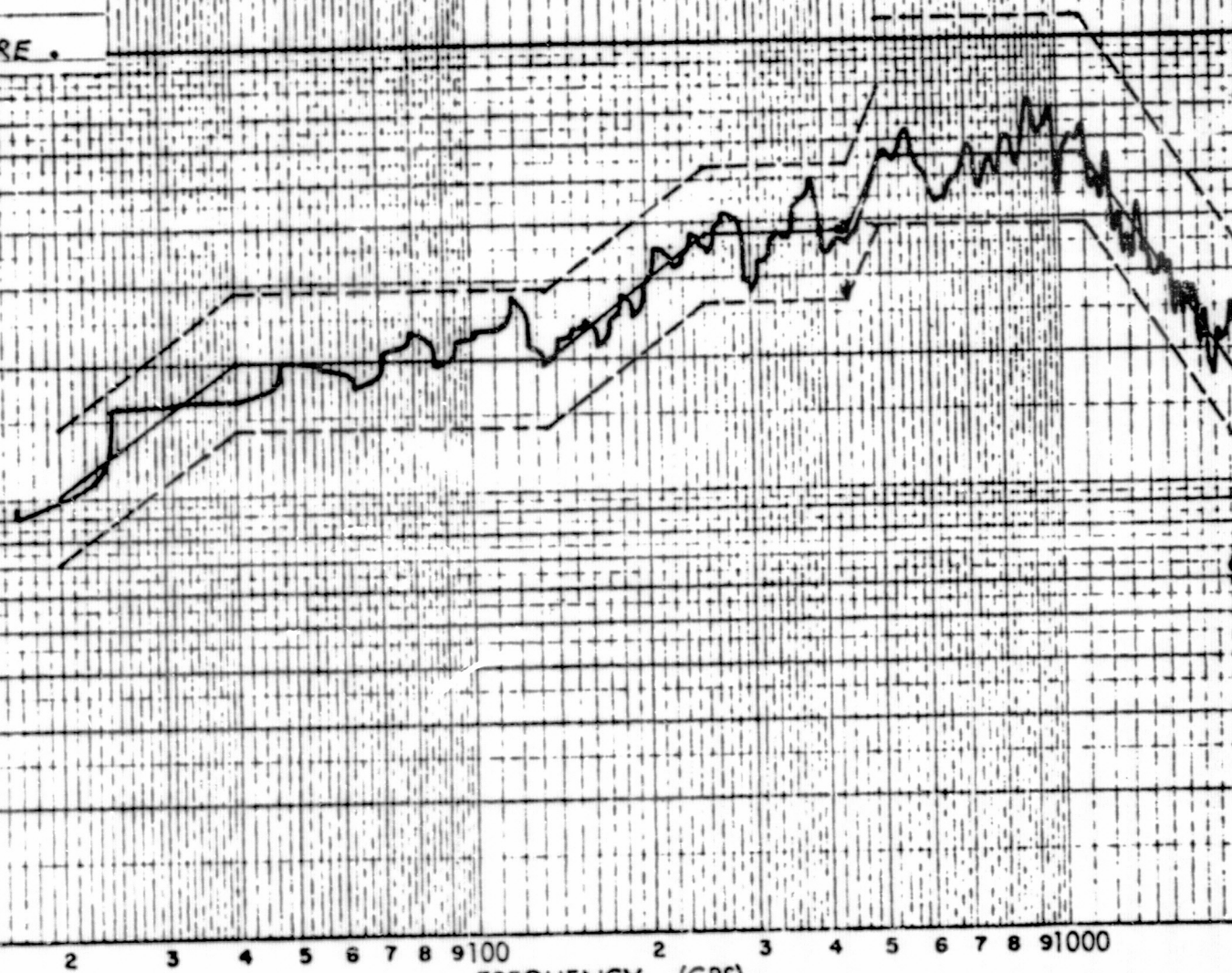
AXIS **X+Z**

LOCATION **ON FIXTURE**

EQUALIZATION

PLOT # 1

ASTL
50
6C



ORIGINAL PAGE IS
OF POOR QUALITY

5 6 7 8 9 10

FREQUENCY - (CPS)

FORM 1002-X-34 NEW 12-71

CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY + ARMING DEVICE

PART NO. 816780

SERIAL NO. 0005 + 0009

DATE 2-17-78

INPUT LEVEL 8.9 GRMS 8.7

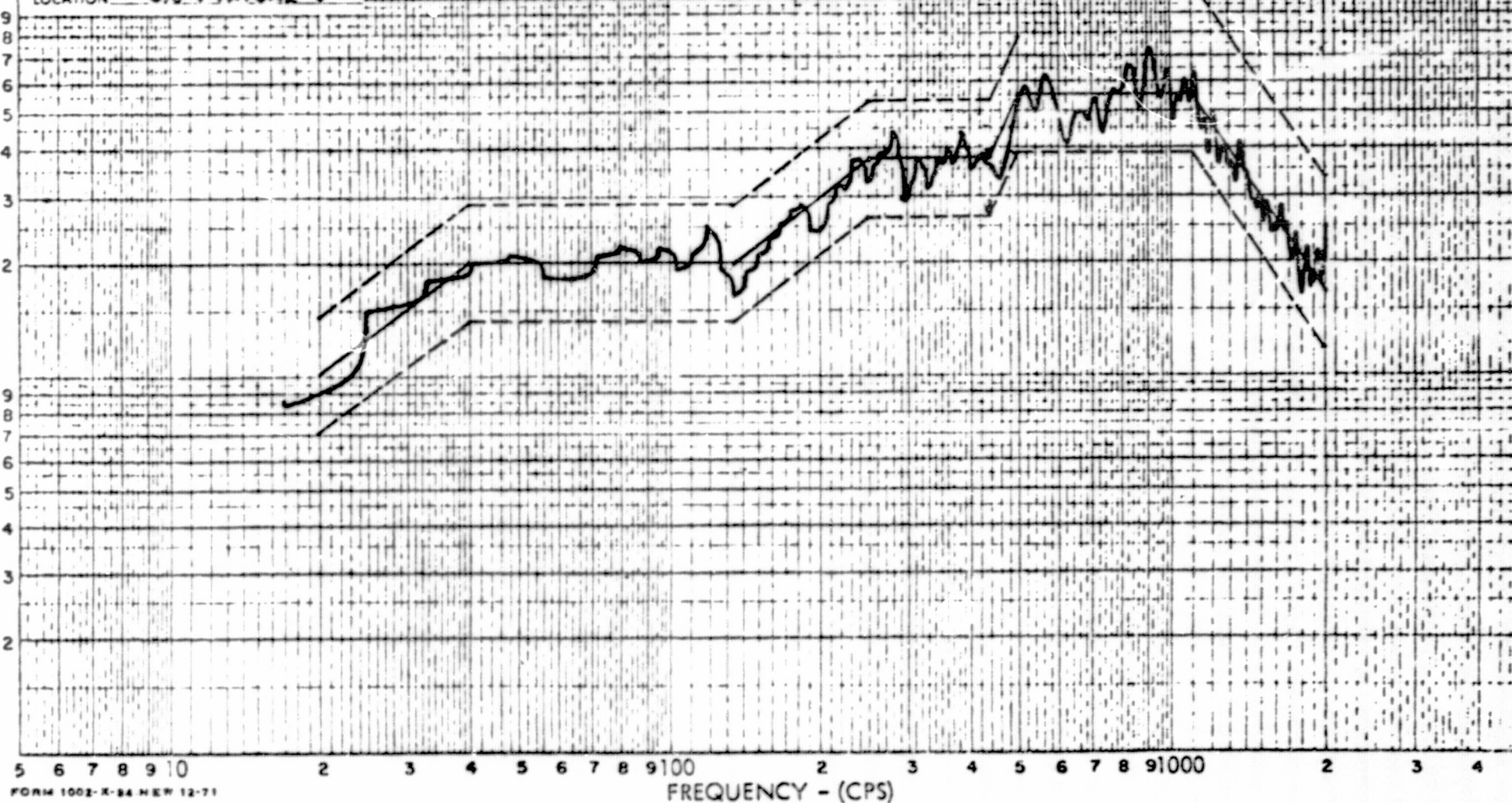
ACCELEROMETER NO. 1

AXIS X

LOCATION ON FIXTURE.

PLOT # 2

ACTL
30
EC



CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY + ARMING DEVICE

PART NO. 816780

SERIAL NO. 0005 + 0009

DATE 2-17-78

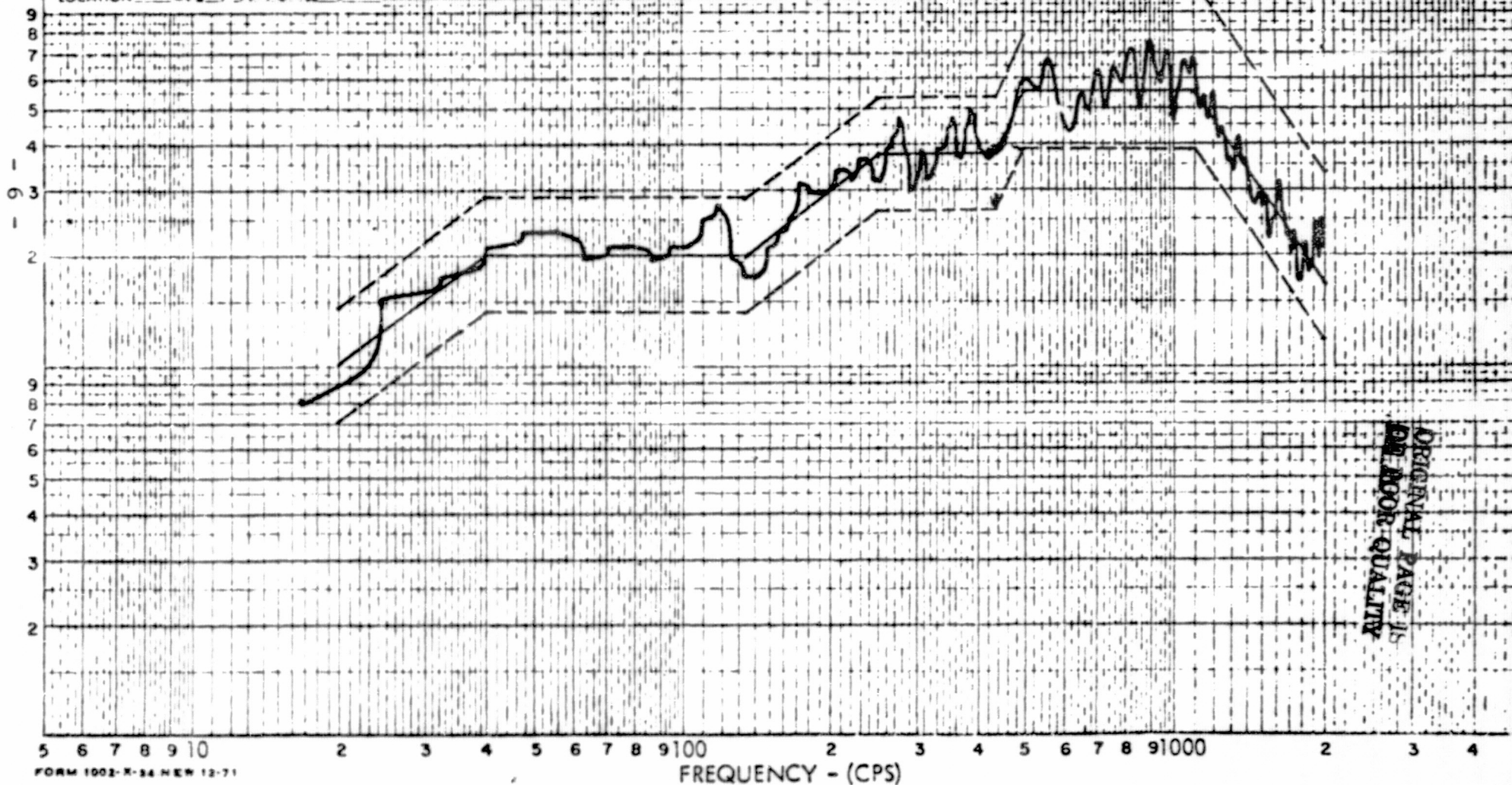
INPUT LEVEL 8.9 GRMS 8.7

ACCELEROMETER NO. 1

AXIS Z

LOCATION ON FIXTURE.

PLOT # 3



9 CUSTOMER TELEDYNE McCORMICK SELPH
8 MJO NO. 773-2612
7 TEST ITEM SAFETY+ARMING DEVICE
6 PART NO. 816780
5 SERIAL NO. 0011 + 0013
4 DATE 2-17-78
3 INPUT LEVEL 8.9 GRMS 8.7
2 ACCELEROMETER NO. 1
1 AXIS Z
LOCATION ON FIXTURE.

Plot # 4

5 6 7 8 9 10

2

3

4

5

6

7

8

9

100

2

3

4

5

6

7

8

9

1000

2

3

4

FREQUENCY - (CPS)

CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY+ARMING DEVICE

PART NO. 816780

SERIAL NO. 0011+0015

DATE 2-17-78

INPUT LEVEL 8.9 GRMS 8.7

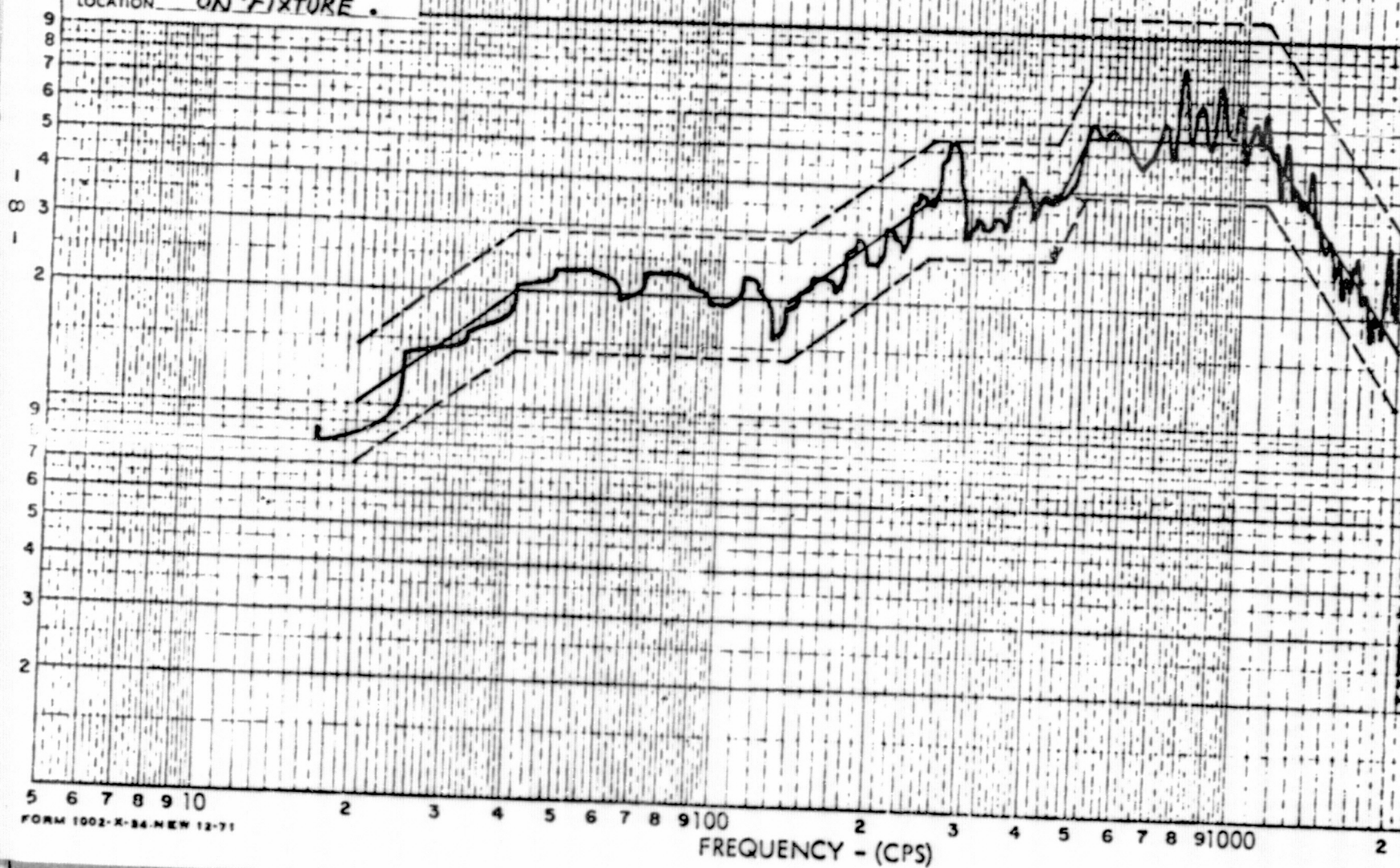
ACCELEROMETER NO. 1

AXIS X

LOCATION ON FIXTURE

APL
50
QC

PLOT # 5



ORIGINAL PAGE IS
OF POOR QUALITY

CUSTOMER *TELEDYNE McCORMICK SELPH*

WJONC *773-2612*

TEST ITEM *SAFETY+ARMING DEVICE*

PART NO. *816780*

SERIAL NO. *0019 + 0020*

DATE *2-17-78*

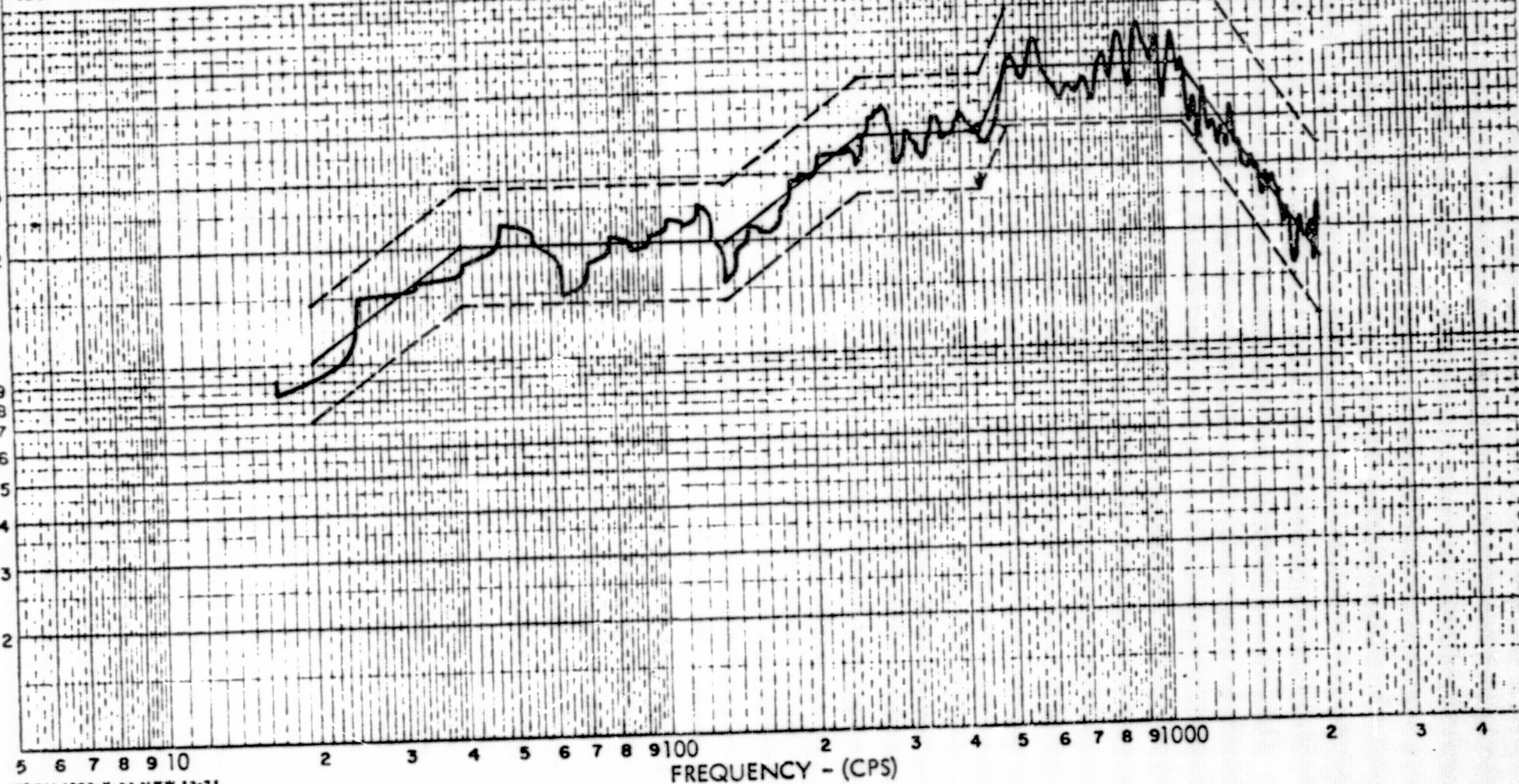
INPUT LEVEL *8.9 GRMS* 8.7

ACCELEROMETER NO. *1*

AXIS *X*

LOCATION *ON FIXTURE*

Plot # *6*



CUSTOMER *TELEDYNE McCORMICK SELPH*

MJO NO. *773-2612*

TEST ITEM *SAFETY+ARMING DEVICE*

PART NO. *816780*

SERIAL NO. *0019 + 0020*

DATE *2-17-78*

INPUT LEVEL *8.9 GRMS* 8.7

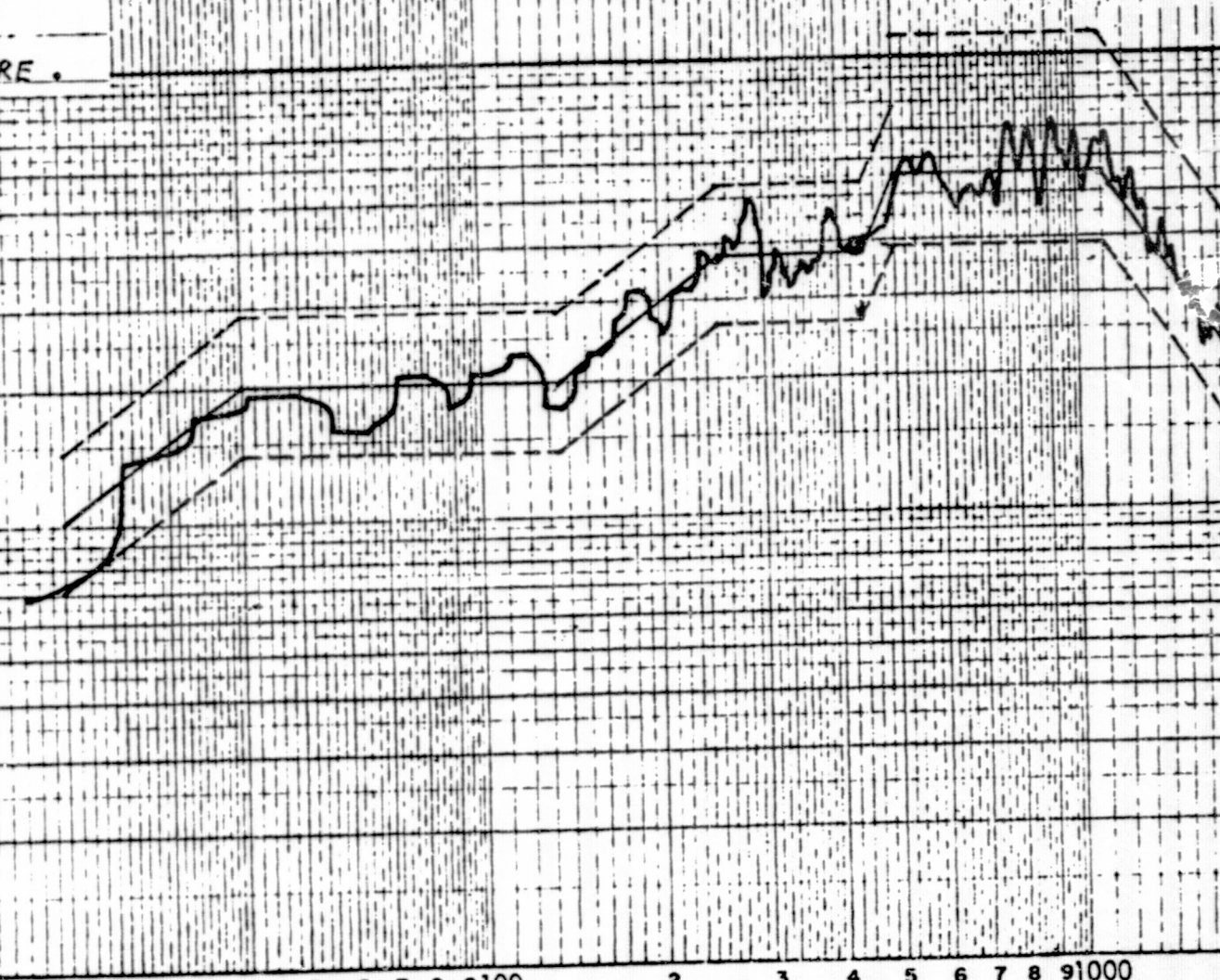
ACCELEROMETER NO. *1*

AXIS *Z*

LOCATION *ON FIXTURE.*

Plot # *7*

10



ORIGINAL PAGE IS
OF POOR QUALITY

CUSTOMER *TELEDYNE McCORMICK SELPH*

MJO NO. *773-2612*

TEST ITEM *SAFETY+ARMING DEVICE*

PART NO. *816780*

SERIAL NO. *0017*

DATE *2-17-79*

INPUT LEVEL *8.9 GRMS*

ACCELEROMETER NO. *1*

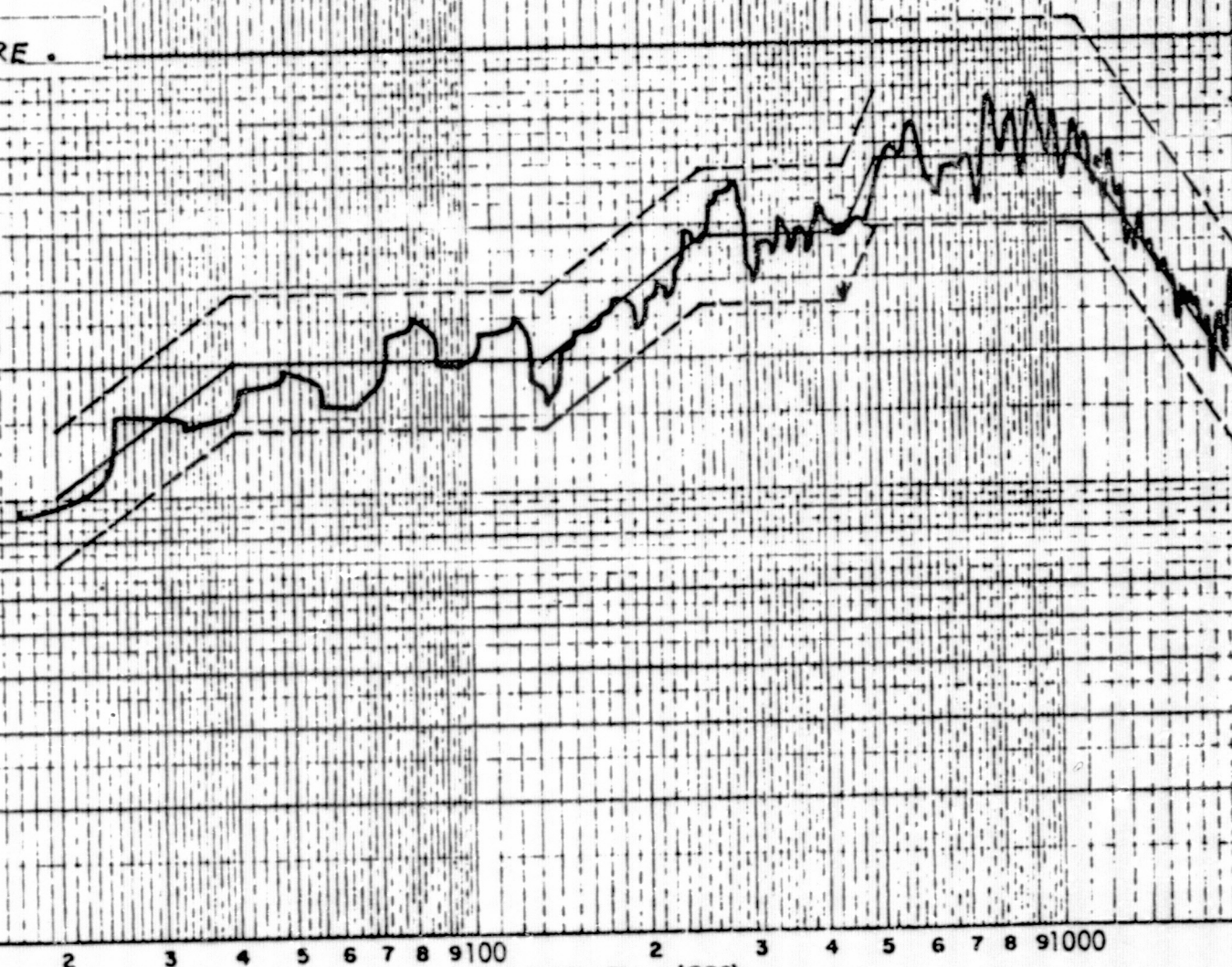
AXIS *Z*

LOCATION *ON FIXTURE.*

8.7

ATC
30
GC

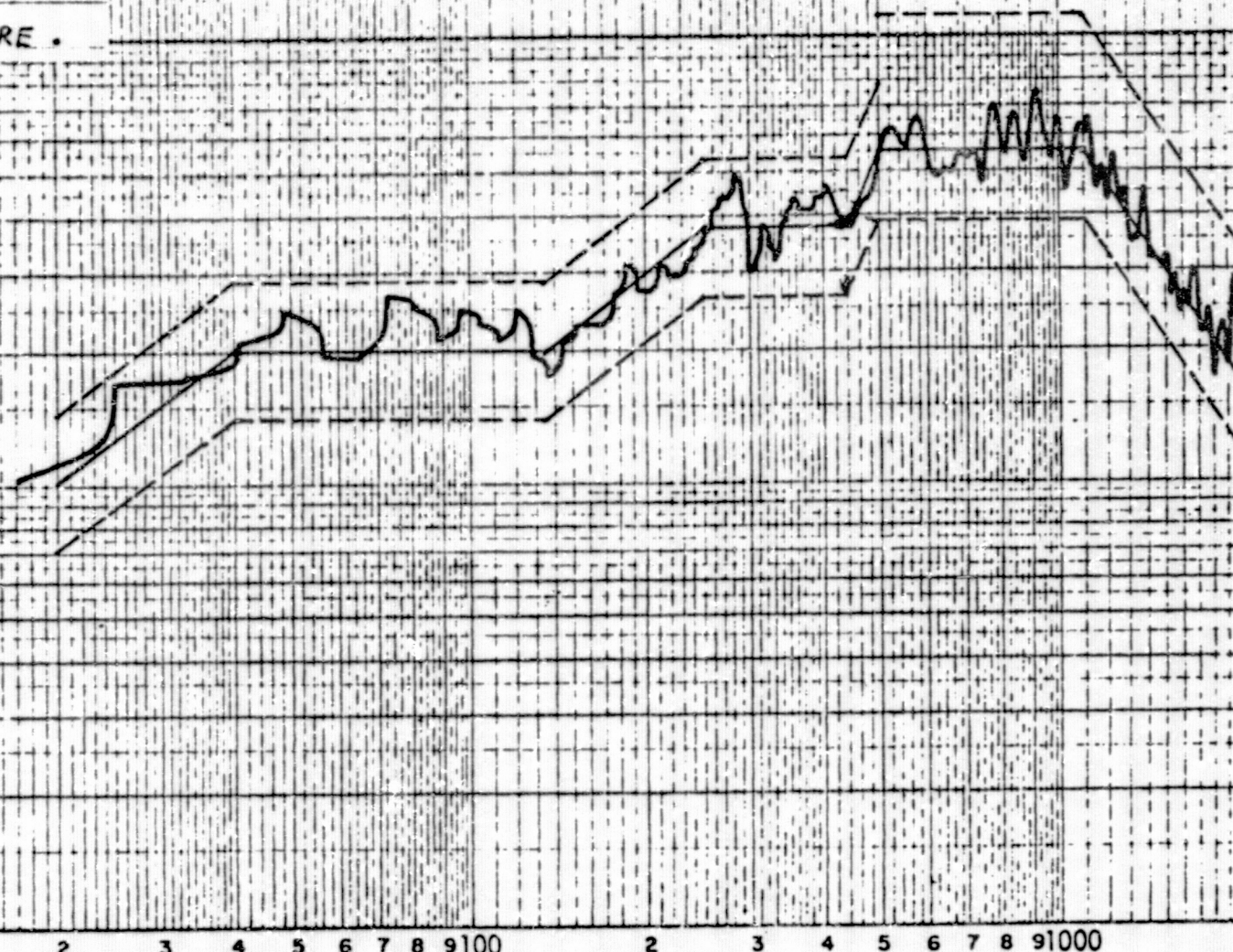
PLOT # *8*



CUSTOMER TELEDYNE McCORMICK SELPH
MJO NO. 773-2612
TEST ITEM SAFETY+ARMING DEVICE
PART NO. 816780
SERIAL NO. 0017
DATE 2-17-78
INPUT LEVEL 8.9 GRMS 8.7
ACCELEROMETER NO. 1
AXIS X
LOCATION ON FIXTURE.

ACTL
30
GC

PLOT # 9



ORIGINAL PAGE IS
OF POOR QUALITY

CUSTOMER **TELEDYNE Mc CORMICK SELPH**

MJO NO. **773-2612**

TEST ITEM **SAFETY ARMING DEVICE**

PART NO. **816780**

SERIAL NO. **FIXTURE**

DATE **2-17-78**

INPUT LEVEL **11.6 GRMS** 11.4

ACCELEROMETER NO. **1**

AXIS **Y**

LOCATION **ON FIXTURE**

EQUILIZATION

PLOT # 10

AETL
30
QC

- 13 -

CH

5 6 7 8 9 10

2

3

4

5

6

7

8

9

100

2

3

4

5

6

7

8

9

1000

2

3

4

FREQUENCY - (CPS)

CUSTOMER TELEDYNE Mc CORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY ARMING DEVICE

PART NO. 816780

SERIAL NO. 0005

DATE 2-17-78

INPUT LEVEL 11.6 GRMS

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE

11.4

PLOT # 11

ORIGINAL PAGE IS
OF POOR QUALITY

FREQUENCY - (CPS)

CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY ARMING DEVICE

PART NO. 816780

SERIAL NO. 0009

DATE 2-17-78

INPUT LEVEL 11.6 GRMS 11.4

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE



CUSTOMER TELEDYNE McCORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY ARMING DEVICE

PART NO. 816780

SERIAL NO. 0011

DATE 2-17-78

INPUT LEVEL 11.6 GRMS

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE

11.4

Plot # 13

ORIGINAL PAGE IS
OF POOR QUALITY

FREQUENCY - (CPS)

5 6 7 8 9 10

2

3

4

5

6

7

8

9

10

2

3

4

5

6

7

8

9

10

2

3

4

FORM 1002-X-24-NEW 12-71

CUSTOMER TELEDYNE Mc CORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY ARMING DEVICE

PART NO. 816780

SERIAL NO. 0013

DATE 2-17-78

INPUT LEVEL 11.6 GRMS 11.4

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE

ACTL
30
DC

PLOT # 14

- 17 -

5 6 7 8 9 10

FORM 1002-X-84-NEW 12-71

2

3

4

5

6

7

8

9

100

2

3

4

5

6

7

8

9

1000

2

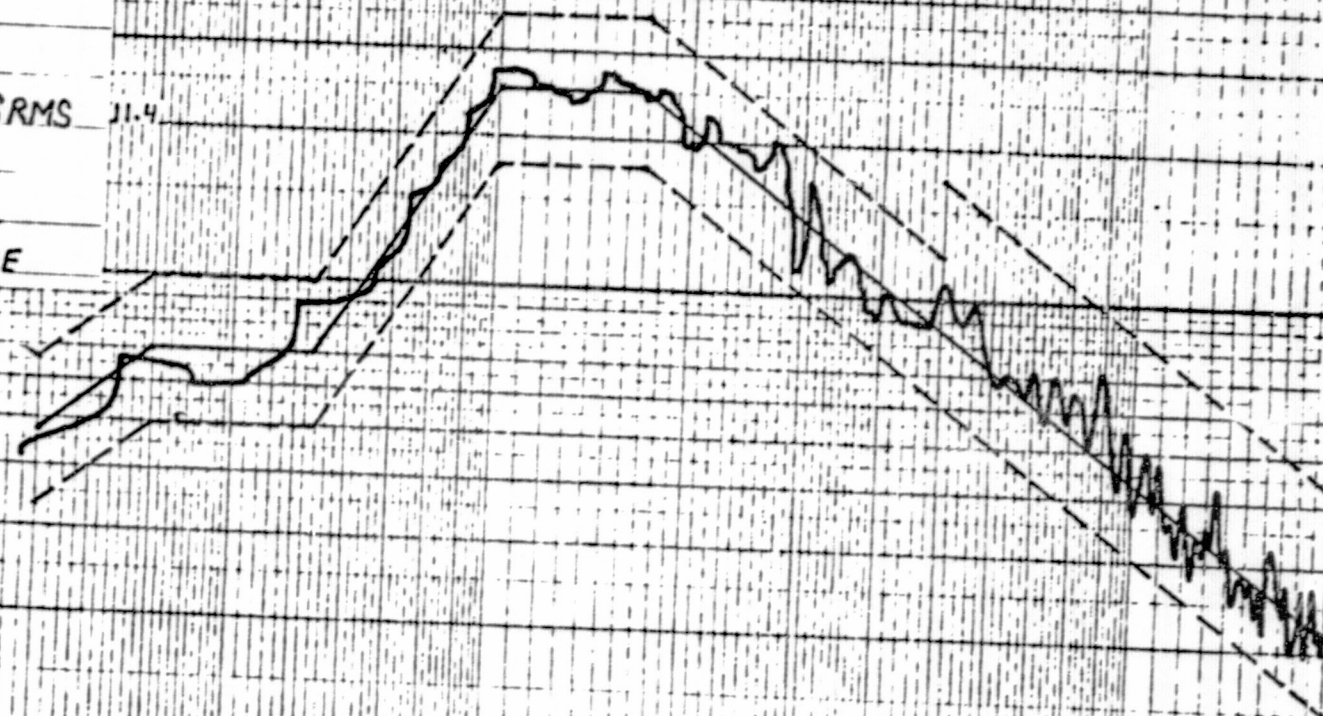
3

4

5

FREQUENCY - (CPS)

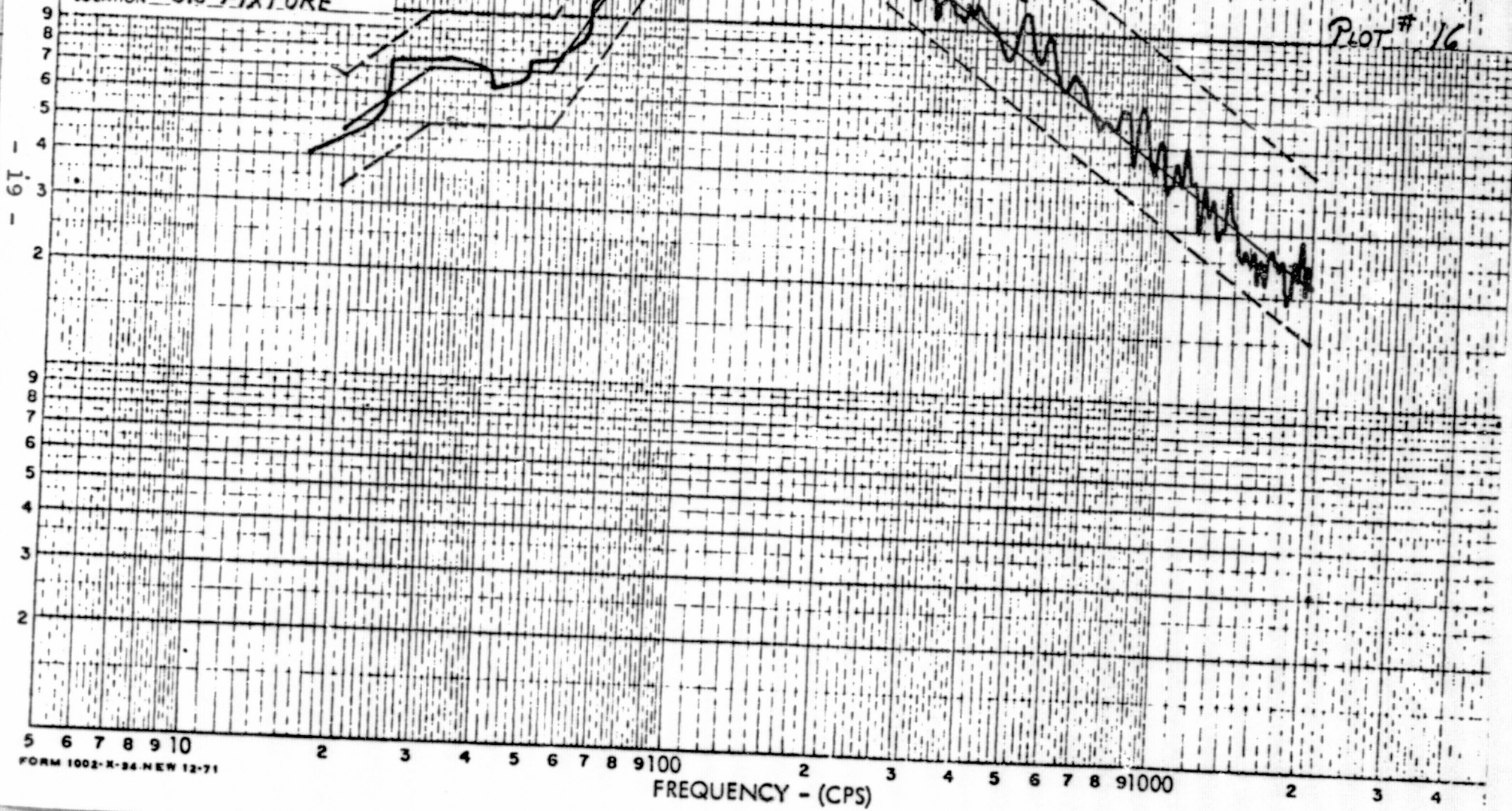
9 CUSTOMER TELEDYNE McCORMICK SELPH
8 MJO NO. 773-2612
7 TEST ITEM SAFETY ARMING DEVICE
6 PART NO. 816780
5 SERIAL NO. 0017
4 DATE 2-17-79
3 INPUT LEVEL 11.6 GRMS 11.4
2 ACCELEROMETER NO. 1
1 AXIS Y
LOCATION ON FIXTURE



ORIGINAL PAGE IS
OF POOR QUALITY

FREQUENCY - (CPS)

9 CUSTOMER TELEDYNE Mc CORMICK SELPH
8
7 MJO NO. 773-2612
6
5 TEST ITEM SAFETY ARMING DEVICE
4 PART NO. 816780
3 SERIAL NO. 0019
2 DATE 2-17-78
INPUT LEVEL 11.6 GRMS 11.4
ACCELEROMETER NO. 1
AXIS Y
LOCATION ON FIXTURE



CUSTOMER TELEDYNE Mc CORMICK SELPH

MJO NO. 773-2612

TEST ITEM SAFETY ARMING DEVICE

PART NO. 816780

SERIAL NO. 0020

DATE 2-17-78

INPUT LEVEL 11.6 GRMS

ACCELEROMETER NO. 1

AXIS Y

LOCATION ON FIXTURE

11.4

PLOT # 17

ATL
30
00

ORIGINAL PAGE IS
OF POOR QUALITY

FREQUENCY - (CPS)

5 6 7 8 9 10

2

3

4

5

6

7

8

9

10

2

3

4

5

6

7

8

9

10

2

3

4

5

FORM 1002-X-34-NEW 12-71

EQUIPMENT LIST

<u>Description</u>	<u>Apparatus</u>	<u>Calibration</u>
<u>RANDOM VIBRATION</u>	Minerva Stop Watch, AETL Control No. G-4121-F	12 months Due 10-25-78
	Ling ASDE-80 Equalizer- Analyzer, AETL Control No. D-4120-F	6 months Due 8-7-78
	Accelerometer Normalizing Amplifier, Model ANA-100, AETL Control No. D-4003-F	6 months Due 7-5-78
	Bruel & Kjaer Accelerometer, Model 4329, AETL Control No. D-4116-F	12 months Due 4-22-78
	Ballantine RMS Meter Model 320, AETL Control No. D-4223-F	6 months Due 4-14-78
	Spectral Dynamics Real Time Analyzer, Model SD330, AETL Control No. D-4125-F	6 months Due 7-23-78
	Esterline Angus X-Y Recorder, Model 575, AETL Control No. D-4080-F	6 months Due 2-22-78
	MB Vibration Exciter, Model C125, AETL Control No. D-4010-F	Not Required
	MB Vibration Amplifier, Model T995, AETL Control No. D-4009-F	Not Required
	Snap-On Torqmeter, Model 0-50" lbs., AETL Control No. G-4136-F	12 months Due 11-23-78

DID NO. _____
CDRL NO. _____
P.O. NO. _____
CONTRACT NO. NAS8-31973

DATA MGR. FILE NO. DTP 816780
DEPT FILE NO. _____
ISSUE DATE 4 May 1977
REVISION A
SUPERSEDING N/C
DATE 4 February 1977

DEVELOPMENT TEST PROCEDURE
FOR
SAFETY AND ARMING DEVICE (S&A)
PN 816780

PREPARED FOR
GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, ALABAMA

Teledyne McCormick Selph

3601 UNION ROAD, HOLLISTER, CALIFORNIA 95023



Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama
35812

JUN 9 1977

Reply to Attn of: EP14(77-174)

Teledyne McCormick Selph
Attn: Mr. R. S. Akin
3501 Union Road
P. O. Box 6
Hollister, California 95023

Subject: SRB Contract NAS8-31973, Safety and Arming Device Development Test Procedure, Acceptance Test Procedure, and Soldering Training Procedure, DTP 816780, Rev. A, ATP 816780, no Revision, and 235041, no Revision

The subject procedures, forwarded by Teledyne McCormick Selph letters C-4918-577-18 and C-4918-577-107, have been reviewed and found acceptable, pending incorporation of the following comments into the Acceptance Test Procedure ATP 816780:

a. Paragraph 3.1.2, Environmental Tests

The word "lead" should be changed to "leak."

b. Paragraph 5.7.5.2

In steps 14 and 15, the word "igniter" should be either removed or replaced with "Alinco."

c. Paragraph 3.1.4 Destructive Tests

All acceptance destructive tests specified in paragraph 4.4.3 and table VI of NASA/MSFC specification 10A00465 must be added.

d. Table I

Acceptance test matrix must be changed to include destructive tests of table VI of NASA/MSFC specification 10A00465.

e. General

A Destructive Test Samples paragraph must be added equal to that in NASA/MSFC Specification 10A00465.

Richard L. Beck

Richard L. Beck

Contracting Officer's Representative

APPROVAL SHEET

H. Koue
Prepared by

5-2-77
Test Engineer
H. Koue

H. Ghilarducci 5-2-77
Manager, Test
H. Ghilarducci

R. McDonald
Quality Engineer
R. McDonald

Frank Mortela
Project Engineer
F. Mortela

C. Campbell
Program Manager
C. Campbell

K. Dixon 5/3/77
Manager, Reliability
K. Dixon

TABLE OF CONTENTS

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE</u>
1.0	SCOPE.	1
2.0	APPLICABLE DOCUMENTS	1
2.1	PRECEDENCE OF DOCUMENTS.	1
2.2	DOCUMENTS.	1
3.0	TEST REQUIREMENTS.	3
3.1	STRUCTURAL INTEGRITY TESTS	3
3.2	EXPLOSIVE TRAIN TESTS.	3
3.3	FULL-SCALE SAFETY AND ARMING DEVICE TESTS. . .	3
4.0	QUALITY ASSURANCE PROVISIONS	6
4.1	TEST DIVISION.	6
4.2	TEST RESPONSIBILITY.	6
4.3	TEST CONDITIONS.	6
4.4	TEST EQUIPMENT	6
4.5	ACCURACY OF TEST EQUIPMENT	7
4.6	SAFETY	7
4.7	TEST REPORTING	7
4.8	TEST DATA.	7
5.0	NONDESTRUCTIVE TESTS	8
5.1	EXAMINATION OF PRODUCT	8
5.2	RADIOGRAPHIC (X-RAY) INSPECTION.	9
5.3	NEUTRON (N-RAY) INSPECTION	11
5.4	LEAKAGE.	13
6.0	STRUCTURAL INTEGRITY TEST.	15
7.0	EXPLOSIVE TRAIN TESTS.	17
8.0	FULL-SCALE SAFETY AND ARMING DEVICE DEVELOPMENT TESTS.	19
8.1	AMBIENT TEMPERATURE ELECTRICAL CHECKOUT. . . .	19
8.2	SINUSOIDAL VIBRATION	23
8.3	RANDOM VIBRATION	26
8.4	SHOCK.	30
8.5	FUNCTION TESTS	32

TABLE OF CONTENTS
(Continued)

<u>TABLES</u>	<u>TITLE</u>	<u>PAGE</u>
I	EXPLOSIVE TRAIN TEST CONFIGURATION	4
II	FULL-SCALE SAFETY AND ARMING DEVICE TESTS. . .	5
III	SINUSOIDAL VIBRATION	23
IV	RANDOM VIBRATION (4.5 MIN/AXIS).	27
V	SHOCK CRITERIA (2 SHOCKS/AXIS)	30
 <u>FIGURES</u>		
1	EXPLOSIVE TRAIN TEST SETUP	18
2	SAFETY AND ARMING DEVICE-SCHEMATIC DIAGRAM . .	22
3	VIBRATION TEST SETUP	25
4	FUNCTION TEST SETUP.	34

DEVELOPMENT TEST PROCEDURE

1.0 SCOPE

This document defines the tests, test conditions and test procedures for development testing of a Safety and Arming Device (S&A) TMC/S PN 816780 to demonstrate compliance to National Aeronautics and Space Administration (NASA) Specification 10A00465.

2.0 APPLICABLE DOCUMENTS2.1 PRECEDENCE OF DOCUMENTS

In the event of conflict between the requirements of this document and the specifications referenced herein, this document shall take precedence.

2.2 DOCUMENTS

The following documents of the issue and date indicated form a part of this procedure to the extent specified herein. Documents not identified herein by a revision date, letter or amendment shall be of the issue in effect by contract on date of this procedure approval.

SPECIFICATIONS

MIL-Q-9858A
16 December 1963

Requirements, Quality Program

MIL-C-45662A
9 February 1962

Requirements, Calibration System

STANDARDS

MIL-STD-453(1)
4 September 1963

Inspection, Radiographic

MIL-STD-831
28 August 1963

Test Reports, Preparation of

MIL-STD-810C
10 March 1975

Environmental Test Methods

2.2

DOCUMENTS (Continued)

OTHER PUBLICATIONSRockwell International DocumentsMT0501-505
25 July 1975

Inspection Neutron Radiography

Teledyne McCormick Selph Drawings

816780

Safety and Arming Device

General ElectricNEDO-12121
May 1974Neutrograph, Service, Quality Control
Procedures and SpecificationsOthers

10A00485

Bracket, Safe and Arm Device

10A00487

Debris Shield

3.0 TEST REQUIREMENTS

The development test program will consist of the following tests:

- a. Structural Integrity (Fragmentation) Tests.
- b. Explosive Train Tests.
- c. Full Scale Safety and Arming Device Tests.

3.1 STRUCTURAL INTEGRITY TEST

These tests are to demonstrate that there is no fragmentation of the S&A body or rotor in the case of inadvertent firing of the NSI detonators with the rotor in the "safe" position. The test units will consist of partially assembled S&A devices less switches, wiring, drive train and other non-essential components. The test is to be conducted per paragraph 6.0.

3.2 EXPLOSIVE TRAIN TESTS

These tests are designed to optimize the explosive lead configuration and demonstrate reliable operation of worst case conditions of explosive lead (rotor) position; explosive lead load variations, interface gaps and low temperature. Test hardware will consist of explosive leads in simulated rotor and bodies as shown in Figure 1.

The test quantity and configurations are given in Table I. The test will be conducted per paragraph 7.0.

3.3 FULL SCALE SAFETY AND ARMING DEVICE TESTS

These tests are to verify that the S&A design will meet basic environmental and performance requirements prior to undertaking the qualification program. These tests will be performed using full scale S&A devices. The test quantity and sequence is given in Table II.

TABLE I
EXPLOSIVE TRAIN CONFIGURATION TEST

Type Test	Test Quantity (45 Total)					
Test Group No.	I	II	III	IV	V	VI 
Test Quantity	5	5	5	5	5	20
<u>Variables</u>						
EXPLOSIVE LEAD LOADING						
Normal load	X	X	X			X
Under load				X		
Over load					X	
EXPLOSIVE LEAD POSITION						
In-Line	X	X	X	X	X	
Displaced (angular)						X
DETONATOR/EXPLOSIVE LEAD GAP						
Normal	X		X	X	X	X
Maximum		X				
EXPLOSIVE LEAD/CDF GAP						
Normal	X	X			X	X
Maximum			X	X		
TEST TEMPERATURE						
Ambient	X		X	X	X	X
-65°F		X				

 Langlie Reliability Test Method for "one-shot items".
Starting limits shall be 8-degree and 45-degree Explosive
Lead Position.

TABLE II
FULL-SCALE SAFE AND ARM TESTS

Type Test	DTP 816780 Paragraph	Test Quantity & Sequence	
		Group I	Group II
Examination of product	5.1	2	2
X-Ray	5.2	2	2
N-Ray	5.3	2	2
Leak	5.4	2	2
Ambient Temperature Electrical Checkout	8.1	2	2
Sinusoidal Vibration	8.2	2	
Random Vibration	8.3	2	
Shock	8.4		2
Leak	5.4	2	2
Low Temperature Function --Armed	8.5	1	1
High Temperature Function --Safe	8.5	1	1

Testing is to be performed on complete S&A devices.
(TMC/S P/N 816780 - MSFC 10A00465)

4.0 QUALITY ASSURANCE PROVISIONS

4.1 TEST DIVISION

The test division is under the jurisdiction of the Quality Assurance Department which is directly responsible for the high standards required by TMc/S Quality Assurance Manual. All test instructions not referenced in this procedure are contained in TMc/S Quality Manual which reflects the requirements of MIL-Q-9858.

4.2 TEST RESPONSIBILITY

Unless deviations are authorized by the customer, testing will be accomplished by TMc/S in accordance with this procedure.

- a. TMc/S will use their facilities or other laboratories acceptable to the customer.
- b. The customer may monitor and perform inspections, etc. as stated in the specifications.
- c. The customer representative shall be notified at least two days in advance of start of testing.

4.3 TEST CONDITIONS

Test laboratory conditions shall be an atmospheric pressure of between 28 and 32 inches of mercury (711.2 - 812.8 mm Hg), a temperature of between +60°F and +90°F (16 - 32°C), and a relative humidity of not more than 90%.

4.4 TEST EQUIPMENT

Except when substitutions become absolutely necessary, the described test equipment shall be used. If equipment substitutions are necessary, equipment of equal or superior accuracy shall be used, as approved by the Test Supervisor.

4.5 ACCURACY OF TEST EQUIPMENT

The accuracy of instruments and facility type test equipment used to control and monitor test parameters shall be calibrated periodically. The accuracy of special test equipment used to control and monitor test parameters shall be validated periodically and the period for validation shall be less than the calibration period of the instruments contained within the special equipment.

- a. Calibration for all measuring and test equipment shall be in accordance with TMc/S Quality Assurance Manual and MIL-C-45662.

4.6 SAFETY

TMc/S safety practices shall be followed. All test equipment and personnel shall be adequately protected and barricaded.

4.7 TEST REPORTING

A test report shall be submitted within thirty (30) days after completion of development testing at TMc/S showing the results of each test. This report shall show evidence of satisfactory completion of all testing performed on the units.

4.8 TEST DATA

All data, charts and reports generated as objective evidence of product conformance to the applicable requirements shall be retained by TMc/S.

5.0 NONDESTRUCTIVE TESTS

5.1 EXAMINATION OF PRODUCT

5.1.1 Reference

- a. NASA Specification 10A00465, paragraph 4.4.2.1.

5.1.2 Number of Components (See Table II)

Four (4) S & A Devices, TMc/S PN 816780.

5.1.3 Test Requirement

All components shall be carefully examined to verify critical dimensions, workmanship, use of proper materials and finishes, and absence of visible defects.

5.1.4 Evaluation

Examination shall be conducted, evaluated, and certified by TMc/S inspection personnel. Any unit which does not meet the requirement of the examination shall be rejected. However, the component may be reworked and resubmitted for inspection.

5.2 RADIOGRAPHIC (X-RAY) INSPECTION

5.2.1 Reference

- a. NASA Specification 10A00465, paragraph 4.4.2.2.1.
- b. MIL-STD-453.

5.2.2 Number of Units

- a. Four (4) full scale S&A assemblies.

5.2.3 Test Requirement

- a. Each unit shall be x-rayed to the requirement of the x-ray, MIL-STD-453.
- b. Each S&A assembly shall be x-rayed in two views, with views 90° to 120° apart along the longitudinal axis.
- c. Two negatives shall be made of each view of each device.
- d. The following identification, as a minimum, shall be permanently attached to each film or negative:

Control Number
Job/WO Number
TMc/S Part Number
NASA Part Number

Lot Number
Serial Number
Current Date

5.2.4 Test Equipment

The radiographic equipment used shall be per MIL-STD-453.

- a. Radiographic records shall be examined by qualified personnel to see that they are properly identified and that quality and clarity of the radiograph permits inspection of the internal components of the assembly. The inspector shall ascertain that certifications are present and are complete.
- b. Criteria for acceptance and rejection upon review of the film shall be as follows:
 - 1) Out-of-position components.
 - 2) Presence of manufacturing liquids and materials.
 - 3) Missing components such as spacers and washers.
 - 4) Excess materials such as solder, flux and adhesive.
- c. A unit which does not meet the requirement of the inspection shall be rejected. However, the unit may be reworked if possible and reinspected. Record must be made for each rework.
- d. Certification and one (1) set of x-ray negatives will be maintained in TMc/S Quality Assurance files for review at TMc/S when requested.
- e. The accept/reject status of each unit shall be recorded on the final acceptance log.

5.3 NEUTRON (N-RAY) INSPECTION

5.3.1 Reference

- a. NASA Specification 10A00465, Paragraph 4.4.2.2.2.
- b. RIC Specification MT0501-505.
- c. General Electric Procedure NEDO-12121, Class I.

5.3.2 Number of Units (See Table II)

- a. All explosive leads
- b. Four (4) each S&A Assemblies.

5.3.3 Test Requirement

- a. Each unit shall be neutron radiographic inspected to the requirements of RIC Specification MT0501-505 and General Electric Procedure NEDO-12121, Class I.
- b. Each S&A Assembly shall be N-rayed in two views, with views 90° to 120° apart along the longitudinal axis.
- c. Each explosive lead shall be N-rayed in one view perpendicular to the longitudinal axis.
- d. Two negatives shall be made of each view of each device.
- e. The following identification, as a minimum, shall be permanently attached to each film or negative:
 - Control Number Lot Number
 - Job/WO Number Serial Number
 - TMc/S Part Number Current Date
 - NASA Part Number
- f. N-Ray will be taken prior to the installation of any name plates.

5.3.4 Evaluation

- a. Radiographic records shall be examined by qualified personnel to see that they are properly identified and that the quality and clarity of the radiograph permits inspection of the internal components of the assembly. The inspector shall ascertain that certifications are present and are complete.

- b. Criteria for acceptance and rejection upon review of the film shall be as follows:
 - 1) Missing, partial, and unconsolidated charges.
 - 2) Shading lines, gaps and imperfections at explosive load interfaces shall not exceed .005 inches wide.
 - 3) Charge density variations.
 - 4) Internal foreign material located in charges, flash holes, etc. (Material and size should be identified to determine resolution capabilities.)
 - 5) Out-of-position components.
 - 6) Presence of manufacturing liquids and materials.
 - 7) Missing components such as spacers and washers.
 - 8) Excess materials such as solder, flux and adhesive.
- c. A unit which does not meet the requirement of the inspection shall be rejected. However, the unit may be reworked if possible and re-inspected. Record must be made of each rework.
- d. Certification and one (1) set of N-Ray negatives will be maintained in the TMC/S Quality Assurance Files for review.
- e. The accept/reject status of each unit shall be recorded on the final acceptance log.

5.4 LEAKAGE

5.4.1 Reference

- a. NASA Specification 10A00465, paragraph 3.3.4.

5.4.2 Number of Units (See Table II)

Four (4) each S&A Assemblies.

5.4.3 Test Requirement

The unit shall have zero leakage for two (2) minutes at one (1) psia pressure (61,000 ft. altitude equivalent).

5.4.4 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib Interval</u>	<u>Range</u>
Vacuum Pump	Cenco	30	N/A	N/A	0-30 in Hg.
Vacuum Gauge	Matheson	63-4101	± 0.5 in. Hg.	Yearly	0-30 in Hg.
Vacuum Chamber (Cradle Type)	TMc/S	N/A	N/A	N/A	N/A

5.4.5 Test Procedure

- Fill the vacuum chamber with distilled water to the level indicating line.
 - Reduce the air pressure above the water to 0.5 inches of mercury (in. Hg) for at least two (2) minutes to boil off trapped air in the water. Water temperature should be plus 50° to 70°F.
 - Attach the unit to the side wall of the vacuum chamber.
- NOTE: With the vacuum chamber rotated in the "no-test" position, the unit shall be above the water level.

5.4.5 Test Procedure (Continued)

- d. Seal the vacuum chamber and rotate the chamber to the "test position".

NOTE: In the "test position" the water level in the chamber shall be a minimum of three (3) inches above the unit.

- e. Reduce the pressure above the water to one (1) psia (51.82 millimeters or 2.04 inches of mercury) for at least one (1) minute.

- f. Perform visual examination of the unit for evidence of continuous release of a stream of or growth of bubbles.

NOTE: Static surface bubbles are not evidence of leakage.

- g. Identify location of all areas of leakage for repairs.

NOTE: Units that indicate leakage may be repaired and re-tested.

- h. Rotate the vacuum chamber to the "no-test" position and then vent bell jar back to laboratory atmospheric pressure.

5.4.6 Evaluation

- a. The unit is acceptable if there is no evidence of leakage (indicated by a continuous release of a stream of or growth of bubbles).
- b. Any unit which does not meet the leakage requirement shall be rejected. However, the unit may be reworked and resubmitted for leakage test. Record must be made of each rework.
- c. The accept/reject status of each unit shall be recorded on the final acceptance log.

6.0 STRUCTURAL INTEGRITY SAFETY TEST6.1 Reference

- a. TMc/S Program Test Outline, Document 816780, paragraph 2.1.1 (d).

6.2 Number of Units

Two (2) assemblies shall be tested.

6.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib.</u> <u>Interval</u>
Power Supply	(TBD)	(TBD)	-----	-----
Debris Shield	NASA	10A00487	-----	-----

6.4 Test Requirement

When the NSI Detonator is installed into the S&A body and fired with the rotor in the "safe" position there shall be no fragmentation of the body or rotor.

6.5 Test Procedure

- a. Identify the type of test on the data sheet.
- b. Install two NSI detonators into the body ports and torque to 115-120 inch-pounds.
- c. Adjust firing power supply to (TBD).
- d. Fire NSI detonators by applying (TBD) to the detonators.

6.6 Evaluation

Examine test item and note any of the following conditions:

- a. Body intact.
- b. Body and/or rotor fragmented.
- c. NSI detonators expelled.

6.6 Evaluation (Continued)

- d. Fragments ejected through vent holes retained by debris retainer or expelled.
- e. Explosive leads initiated or intact.
- f. CDF line initiated or not.

7.0 EXPLOSIVE TRAIN TESTS7.1 Reference

- a. TMc/S Program Test Outline Document 816780, paragraph 2.1.1.

7.2 Number of Units (See Table I)

Forty-five (45) tests will be performed.

7.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>
Firing Unit	NASA	C72-0833

7.4 Test Requirement

Perform forty-five (45) tests of the explosive train. Test parameters and configurations are identified in Table I.

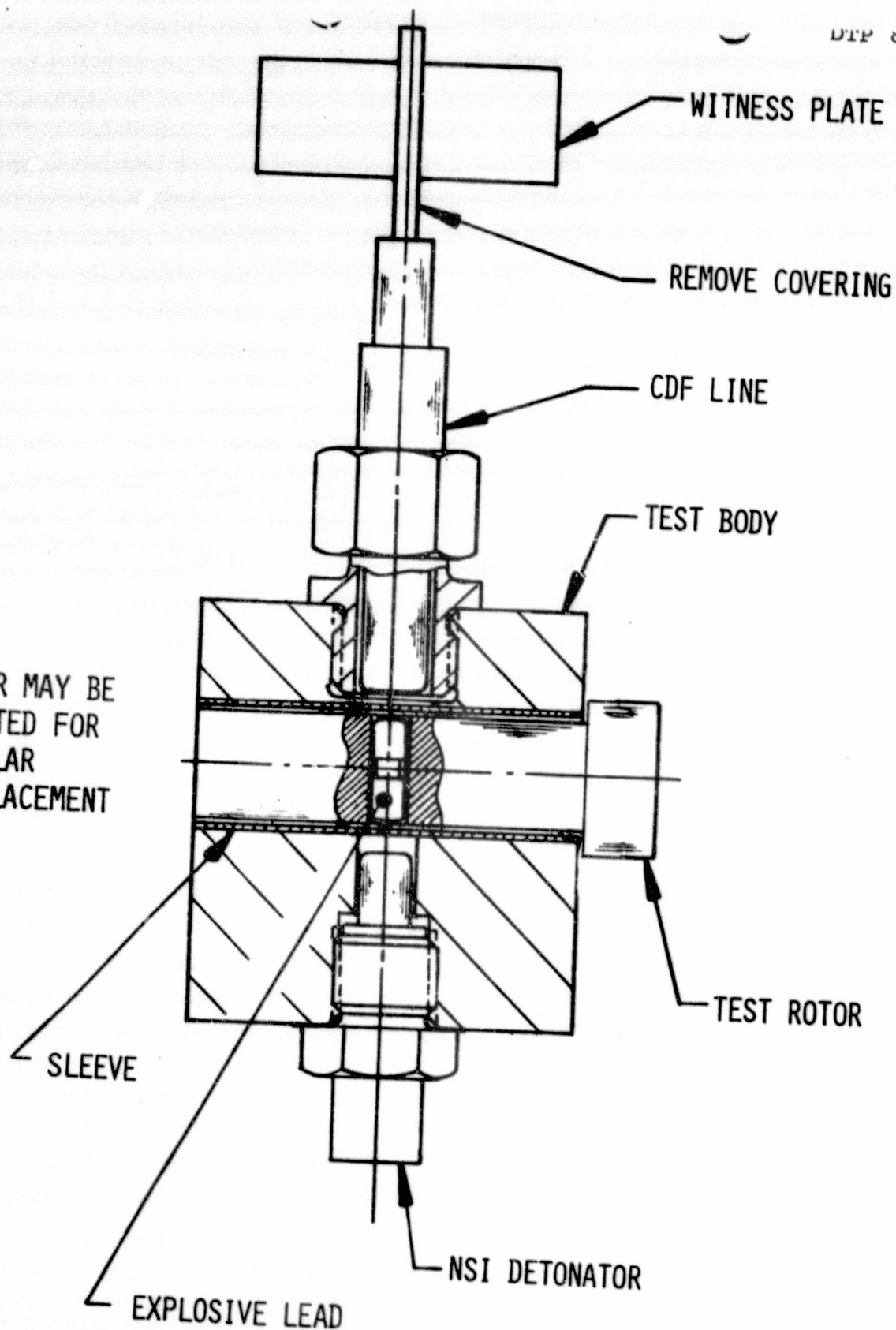
7.5 Test Procedure

- a. Identify type of test on data sheet.
- b. Torque NSI detonator into test body at 115 to 120 inch-pounds.
- c. Install CDF lines and torque to 60-90 inch-pounds. Attach bare sheath of CDF line to witness plate using masking tape.
- d. Initiate the NSI detonator using the NASA firing unit.

7.6 Evaluation

Evaluation shall be established during development testing.

ROTOR MAY BE
ROTATED FOR
ANGULAR
DISPLACEMENT



EXPLOSIVE TRAIN TEST SETUP

FIGURE I

8.0 FULL-SCALE SAFETY AND ARMING DEVICE DEVELOPMENT TESTS8.1 AMBIENT TEMPERATURE ELECTRICAL CHECKOUT8.1.1 Reference

- a. NASA Specification 10A00465, paragraph 4.3.10.

8.1.2 Units to be Tested

Four (4) each (Groups I and II)

8.1.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib. Interval</u>
Power Supply	Perkins	TVCR- 040-15	N/A	N/A
D.C. Voltmeter	Weston	901	+ 0.5V	3 Months
Counter-Timer	Monsanto	1000	+ 1 msec	3 Months
Ammeter	Weston	931	+ 0.015A	3 Months
Megohmmeter	Freed	1620	+ 5 megohms	3 Months
Oscilloscope	Tektronix	502	+ 12 mv	3 Months

8.1.4 Test Requirement

Perform all Electrical Checkouts at standard laboratory ambient test conditions. Cycle the S&A device from Safe to Armed to Safe four (4) times each at voltage inputs of 24 Vdc, 28 Vdc, and 32 Vdc. The current required to actuate the solenoid or motor shall be monitored and recorded with each application of power. Elapsed time for 90° rotation shall not exceed 250 msec.

Using external electrical circuitry as required, a regulated power supply having a range of approximately 15 to 35 vdc, volt-ohmmeter, ammeter, recording instrument and a megohmmeter, the following checkout procedures shall be performed:

- a. Connect external electrical circuitry between the safety and arming device and the dc power source.

CAUTION NOTE:

THE SAFETY AND ARMING DEVICE SHOULD BE IN THE "SAFE" POSITION WHEN RECEIVED. UPON COMPLETION OF CHECKOUT, IT SHALL BE RETURNED TO THE "SAFE" POSITION. THE LOADED MODEL CONTAINS HIGH EXPLOSIVE CHARGES. CONDUCT ALL TESTS IN AN AREA AND IN ACCORDANCE WITH PROCEDURES APPROVED BY THE LOCAL SAFETY DEPARTMENT.

- b. NOTE: Power applied across pins K and M will rotate rotor from SAFE to ARMED position, and power applied across pins R and M will rotate rotor from ARMED to SAFE position.

Cycle Safety and Arming devices from SAFE to ARM to SAFE four (4) times. The voltage inputs shall be 24 Vdc, 28 Vdc, and 32 Vdc. The current required to actuate the solenoid shall not exceed three (3) amperes. During this test, the current required to actuate the solenoid shall be monitored and recorded with each application of power. Ascertain that there is no sluggishness of action by measuring rotor response time. Elapsed time for 90° rotation shall not exceed 250 milliseconds at 28 Vdc.

- c. Make circuitry check at each position, as noted below (figure 2):

- 1) With the rotor in the SAFE position, check the following circuits: G-H, K-N, P-R and S-T. The pin-to-pin voltage drop should be less than 750 millivolts at a current of 2.5 amperes. A resistance check across pins J-H, K-L, R-N and T-U should indicate an open circuit.

8.1.5

Test Procedure (Continued)

- 2) With the rotor in the ARMED position, check the following circuits: J-H, K-L, R-N and T-U. The pin-to-pin voltage drop should be less than 750 millivolts at a current of 2.5 amperes. A resistance check across pins G-H, K-N, P-R, and S-T should indicate an open circuit.

NOTE: Upon completion of check, return rotor to SAFE position.

- d. After disconnection of the 28 Vdc power source make an insulation resistance check using a megohmmeter. The insulation resistance between the current carrying parts and the case shall be greater than 100 megohms at 500 Vdc. Points to be checked shall be the following pins to case: F, G, H, J, K, L, M, N, P, R, S, T, and U. Do not check insulation resistance through anodized surfaces of the body.
- e. With the unit in the SAFE position, check the following circuits, F-M and V case. The pin-to-pin and pin-to-case voltage drop should be less than 750 millivolts at a current of 2.5 amperes.

NOTE: The exterior surface of the device is anodized. Check pin V-case at the PT02H-14-19P connector only.

- f. With the rotor in the SAFE position, verify that an open circuit exists between the following pins:

V-A	V-D	V-G	V-K	V-N	V-S
V-B	V-E	V-H	V-L	V-P	V-T
V-C	V-F	V-J	V-M	V-R	V-U

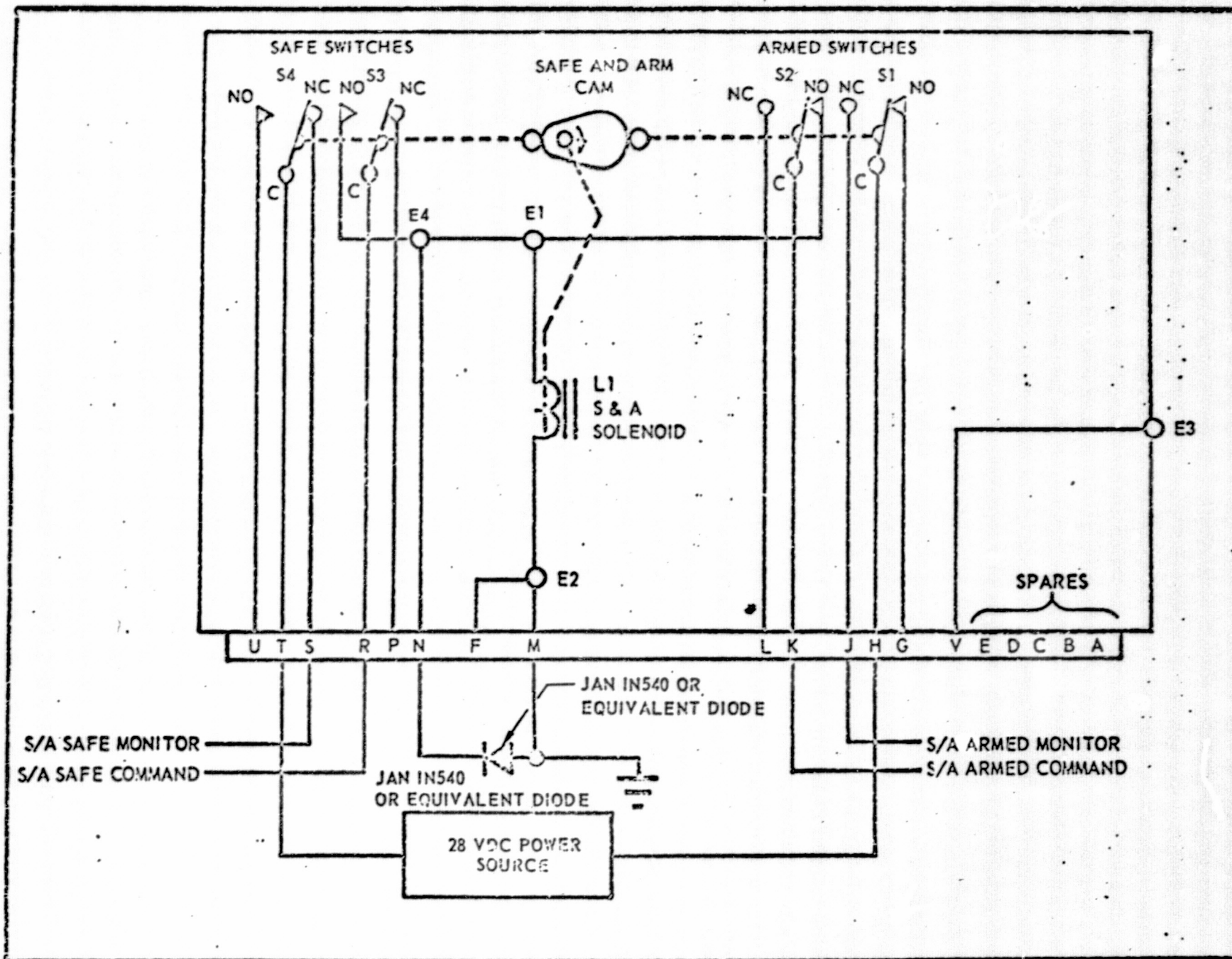


FIGURE 2. SAFETY AND ARMING DEVICE - SCHEMATIC DIAGRAM

8.2 SINUSOIDAL VIBRATION

8.2.1 Reference

- a. NASA Specification 10A00465, paragraph 4.3.6.

8.2.2 Units to be Tested

Group I - Two (2) each (See Table II).

8.2.3 Test Equipment

A list of the test equipment used will be in the test report provided by the outside test laboratory conducting the vibration test.

8.2.4 Test Requirements

Each unit shall be mounted onto the vibration table as shown in Figure 3. Subject each unit to the vibration levels and duration shown in Table III. The specified levels shall be applied at laboratory ambient condition with the unit in the ARMED position. One sweep shall be performed in all three mutually perpendicular axes of the unit. The sweep rate shall be 3.0 octaves per minute. The switch position shall be monitored during the test. After each axis of vibration, the unit shall be rotated from ARM to SAFE to ARM. The elapsed time for each 90 degrees rotation shall not exceed 250 milliseconds.

TABLE III
SINUSOIDAL VIBRATION

<u>Rate</u>	<u>Frequency (Hz)</u>	<u>Level</u>
Three (3)	3.0 - 8.5	0.80 in. d.a.
Octaves per	8.5 - 35.0	3.0 g's peak
Minute	35.0 - 50.0	1.0 g peak

NOTE: Test tolerances per MIL-STD-810.

8.2.5

Test Procedure

- a. Attach the unit to the vibration fixture as shown in Figure 3 and record bolt torque value.
- b. Take a typical photograph (axis optional) of the test set-up.
- c. Subject each unit to sinusoidal vibration at levels specified in Table III and in each of the three mutually perpendicular axes of the unit as shown in Figure 3.
- d. Cycle the unit from ARM to SAFE to ARM after completion of each axis of vibration.
- e. Record number of cycles and elapsed time for each 90 degree rotation.
- f. Monitor the S&A switches during vibration for indication of rotor rotation greater than 7.5°.

8.2.6

Evaluation

- a. No visible damage shall be observed.
- b. There shall be no rotor rotation greater than 7.5°.
- c. The elapsed time for each 90 degree rotation shall not exceed 250 milliseconds and the switches shall properly indicate rotor position.
- d. All units shall next be subjected to random vibration.

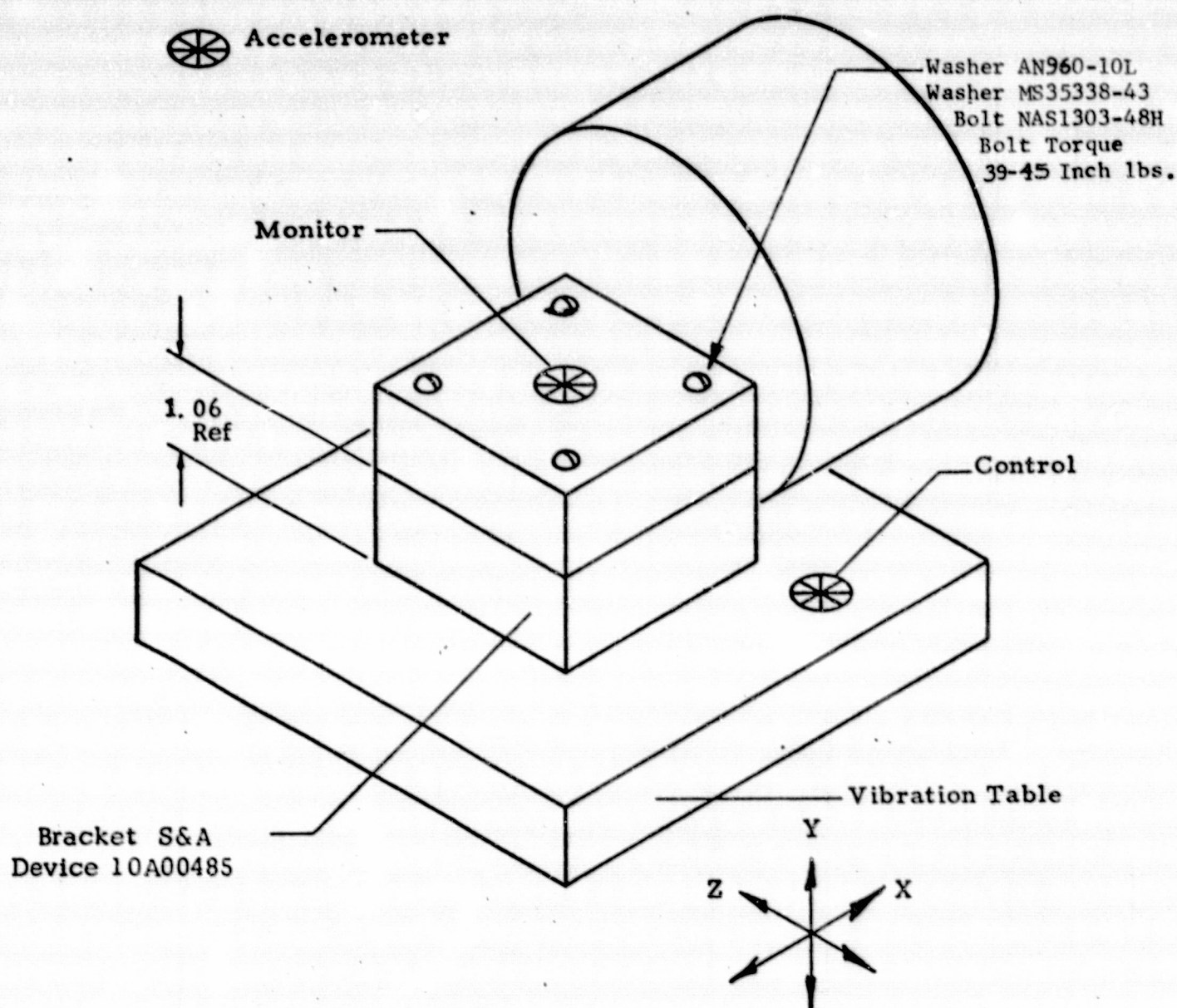


FIGURE 3
VIBRATION AND SHOCK TEST SETUP

8.3 RANDOM VIBRATION

8.3.1 Reference

- a. NASA Specification 10A00465, paragraph 4.3.6.
- b. MIL-STD-810.

8.3.2 Units to be Tested

Group I - two (2) each (see Table II).

8.3.3 Test Equipment

A list of the test equipment used will be in the test report provided by the outside test laboratory conducting the Random Vibration Test.

8.3.4 Test Requirements

Each unit shall be mounted onto the vibration table as shown in Figure 3. Subject each unit to the vibration levels and duration shown in Table IV. The lift-off and boost random levels of Table IV shall be applied for the time durations specified in Table IV with the unit in the ARMED position. The re-entry random vibration level of Table IV shall be applied for the time duration specified in Table IV with the unit in the SAFE position. All testing shall be at laboratory ambient conditions. The switch position shall be monitored during the test. After each axis of vibration the device shall be cycled from SAFE to ARMED to SAFE. The elapsed time for 90° rotation shall not exceed 250 milliseconds. All test tolerances shall be per MIL-STD-810 except the lower spectral density tolerance shall be minus 30 percent.

|
A
|

TABLE IV
LIFT-OFF, BOOST AND REENTRY RANDOM VIBRATION

1. Lift-off Random Vibration Criteria (a) Test duration (60 sec/axis)

Y AXIS (ARMED POSITION)	X AND Z AXES (ARMED POSITION)
20 Hz @ 0.075 g ² /Hz	20 Hz @ 0.040 g ² /Hz
20 - 40 Hz @ +3 dB/Oct.	20 - 40 Hz @ +3 dB/Oct.
40 - 54 Hz @ 0.15 g ² /Hz	40 - 280 Hz @ 0.08 g ² /Hz
54 - 100 Hz @ +9 dB/Oct.	280 - 400 Hz @ +6 dB/Oct.
100 - 170 Hz @ 0.95 g ² /Hz	400 - 800 Hz @ 0.16 g ² /Hz
170 - 2000 Hz @ -3 dB/Oct.	800 - 2000 Hz @ -6 dB/Oct.
2000 Hz @ 0.082 g ² /Hz	2000 Hz @ 0.026 g ² /Hz
Composite = 22.2 grms	Composite = 13.2 grms

2. Boost Random Vibration Criteria (b) Test duration (120 sec/axis)

Y AXIS (ARMED POSITION)	X AND Z AXES (ARMED POSITION)
20 Hz @ 0.14 g ² /Hz	20 Hz @ 0.028 g ² /Hz
20 - 40 Hz @ +3 dB/Oct.	20 - 40 Hz @ +3 dB/Oct.
40 - 53 Hz @ 0.28 g ² /Hz	40 - 95 Hz @ 0.056 g ² /Hz
53 - 100 Hz @ +6 dB/Oct.	95 - 250 Hz @ +3 dB/Oct.
100 - 170 Hz @ 1.0 g ² /Hz	250 - 440 Hz @ 0.15 g ² /Hz
170 - 2000 Hz @ -3 dB/Oct.	440 - 500 Hz @ +9 dB/Oct.
2000 Hz @ 0.09 g ² /Hz	500 - 800 Hz @ 0.22 g ² /Hz
	800 - 2000 Hz @ -6 dB/Oct.
	2000 Hz @ 0.035 g ² /Hz
Composite = 22.9 grms	Composite = 15.2 grms

(A)

TABLE IV
(Continued)

3. Reentry Random Vibration Criteria Test duration (90 sec/axis)

Y AXIS (SAFE POSITION)	X AND Z AXES (SAFE POSITION)
20 Hz @ $0.50 \text{ g}^2/\text{Hz}$	20 - 40 Hz @ $0.75 \text{ g}^2/\text{Hz}$
20 - 40 Hz @ +3 dB/Oct.	40 - 60 Hz @ -12 dB/Oct.
40 - 60 Hz @ $1.00 \text{ g}^2/\text{Hz}$	60 - 400 Hz @ $0.13 \text{ g}^2/\text{Hz}$
60 - 75 Hz @ -12 dB/Oct.	400 - 2000 Hz @ -3 dB/Oct.
75 - 230 Hz @ $0.36 \text{ g}^2/\text{Hz}$	2000 Hz @ $0.026 \text{ g}^2/\text{Hz}$
230 - 500 Hz @ -12 dB/Oct.	
500 - 1000 Hz @ $0.017 \text{ g}^2/\text{Hz}$	
1000 - 2000 Hz @ -6 dB/Oct.	
2000 Hz @ $0.0042 \text{ g}^2/\text{Hz}$	
Composite = 11.9 grms	Composite = 12.2 grms

(A)

8.3.5

Test Procedure

- a. Attach the unit to the vibration fixture as shown in Figure 3 and record bolt torque value.
- b. Test conditions are laboratory ambient.
- c. Perform an equilization run prior to the actual test.
- d. Vibration shall be applied along the three (3) mutually perpendicular axes of the unit as shown in Figure 3.
- e. Place the unit in the ARMED Position and vibrate at the lift-off levels specified in Table IV for sixty (60) seconds per axis.
- f. Vibrate the unit at the boost levels specified in Table IV for one hundred twenty (120) seconds per axis.
- g. Place the unit in the SAFE position and vibrate at the reentry levels specified in Table IV for one and one-half (1.5) minutes per axis.
- h. Record all power spectral density levels.
- i. Cycle the unit from SAFE to ARM to SAFE after completion of each axis of vibration.
- j. Record number of cycles and elapsed time for 90 degree rotation.
- k. Monitor the S&A switches during vibration for indication of rotor rotation greater than 7.5°.

(A)

8.3.6

Evaluation

- a. No visible damage shall be observed.
- b. There shall be no rotor rotation greater than 7.5°.
- c. The elapsed time for 90° rotation shall not exceed 250 milliseconds and the switches properly indicate rotor position.
- d. Subject both units to the leakage test (paragraph 5.4) upon completion of random vibration and to the remaining tests listed in Table II.

8.4 SHOCK

8.4.1 Reference

- a. NASA Specification 10A00465, paragraph 4.3.9.

8.4.2 Units to be Tested

Group II - two (2) each (see Table II).

8.4.3 Test Equipment

A list of the test equipment used will be in the test report provided by the outside test laboratory conducting the shock tests.

8.4.4 Test Requirements

Each unit shall be mounted onto the shock fixture as shown in Figure 3. Subject the unit to the shock criteria specified in Table V. Test conditions shall be laboratory ambient. The unit shall be in the SAFE position. The switch position shall be monitored during the test. After each axis of shock the device shall be cycled from SAFE to ARMED to SAFE. The elapsed time for 90° rotation shall not exceed 250 milliseconds.

8.4.5 Test Procedure

- a. Attach the unit to the test fixture as shown in Figure 3, place the unit in the SAFE position, and record bolt torque value.
- b. Test conditions are laboratory ambient.
- c. All units shall be subjected to two shock impacts in the X, Y, and Z axis shown in Figure 3.
- d. Subject each unit to the Ordnance, SRB Water Landing and SRB Parachute deployment shock levels shown in Table V.

8.4.5 Test Procedure (Continued)

DTP 816780

- e. Monitor the S&A switches during testing for indication of rotor rotation greater than 7.5°.
- f. Cycle the unit from SAFE to ARM to SAFE after completion of each axis of shock.
- g. Record number of cycles and elapsed time for 90 degree rotation.

8.4.6 Evaluation

- a. There shall be no rotor rotation greater than 7.5°.
- b. There shall be no evidence of damage upon completion of all shock testing.
- c. The elapsed time for 90° rotation shall not exceed 250 milliseconds and the switches properly indicate rotor position.
- d. Subject both units to the leakage test (paragraph 5.4) upon completion of random vibration and to the remaining tests listed in Table II.

TABLE V

SHOCK CRITERIA (2 SHOCKS/AXIS)

Ordnance Shock

- 50- 100 Hz at 12 dB/oct.
- 100 Hz at 94 G's peak
- 100- 4,000 Hz at 6 dB/oct.
- 4,000-10,000 Hz at 1,875 G's peak

SRB Water Landing

Longitudinal Axis

Half Sine Pulse
30 G's Peak Amplitude
150 msec Duration

Lateral Axes

Half Sine Pulse
20 G's Peak Amplitude
100 msec Duration

SRB Parachute Deployment

Longitudinal Axis

Half Sine Pulse
6 G's Peak Amplitude
300 msec Duration

Lateral Axes

Half Sine Pulse
11 G's Peak Amplitude
300 msec Duration

8.5 FUNCTION TESTS

8.5.1 Reference

- a. NASA Specification 10A00465, paragraph 4.3.12/4.3.15.

8.5.2 Units to be Tested

Group I - one (1) each function ARMED at plus 20 $\pm$ 5°F.
 one (1) each function SAFE at plus 165 $\pm$ 5°F.
 Group II- one (1) each function ARMED at plus 20 $\pm$ 5°F.
 one (1) each function SAFE at plus 165 $\pm$ 5°F.

8.5.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	
Detonator Cartridge	SOS	ME453-0021	Supplied by NASA
CDF	N/A	N/A	Supplied by NASA
Al. Tubing	N/A	6061-0	.125 OD x .020 Wall
Firing Unit	NASA	C72-0833	Supplied by NASA
Debris Shield	NASA	10A00487	

8.5.4 Test Requirements

One (1) unit from Group I and one (1) unit from Group II shall be in the ARMED position and functioned at plus 20°F. One (1) unit from Group I and one (1) unit from Group II shall be in the SAFE position and functioned at plus 165°F. The test set-up shall be per Figure 4.

8.5.5 Test Procedure (See Figure 4)

- a. Torque the NASA supplied detonator cartridges into each S&A device as 115-120 inch-pounds.
- b. Install the 10A00487 debris shield ("SAFE" test only).

8.5.5 Test Procedure (Continued)

- c. Torque the NASA supplied CDF test lead assemblies into each S&A device at 60-90 inch-pounds.
- d. Remove the protective wrap from each CDF assembly to expose at least 1.62 inches of MDF.
- e. Install the 6061-0 aluminum tube over each section of MDF as shown in Figure 4.
- f. Place the unit into the temperature conditioning chamber and expose the unit to the specified temperature (see "Unit to be Tested" paragraph) for a minimum duration of one (1) hour.
- g. Cycle the unit from SAFE to ARM to SAFE while the unit is at the specified temperature.
- h. Record the number of cycles and elapsed time for 90 degree rotation.
- i. Remove the unit from the chamber, and initiate each detonator by the NASA firing unit within five (5) minutes after removal from the chamber.

8.5.6 Evaluation

- a. The elapsed time for 90 degree rotation shall not exceed 250 milliseconds and the switches properly indicate rotor position.
- b. "ARMED" Function Test: The aluminum sleeve on each CDF test lead assembly shall be completely ruptured to indicate satisfactory operation of the test specimen.
- c. "SAFE" Function Test: The CDF line shall not have initiated. There shall be no fragmentation of the S&A body or rotor.

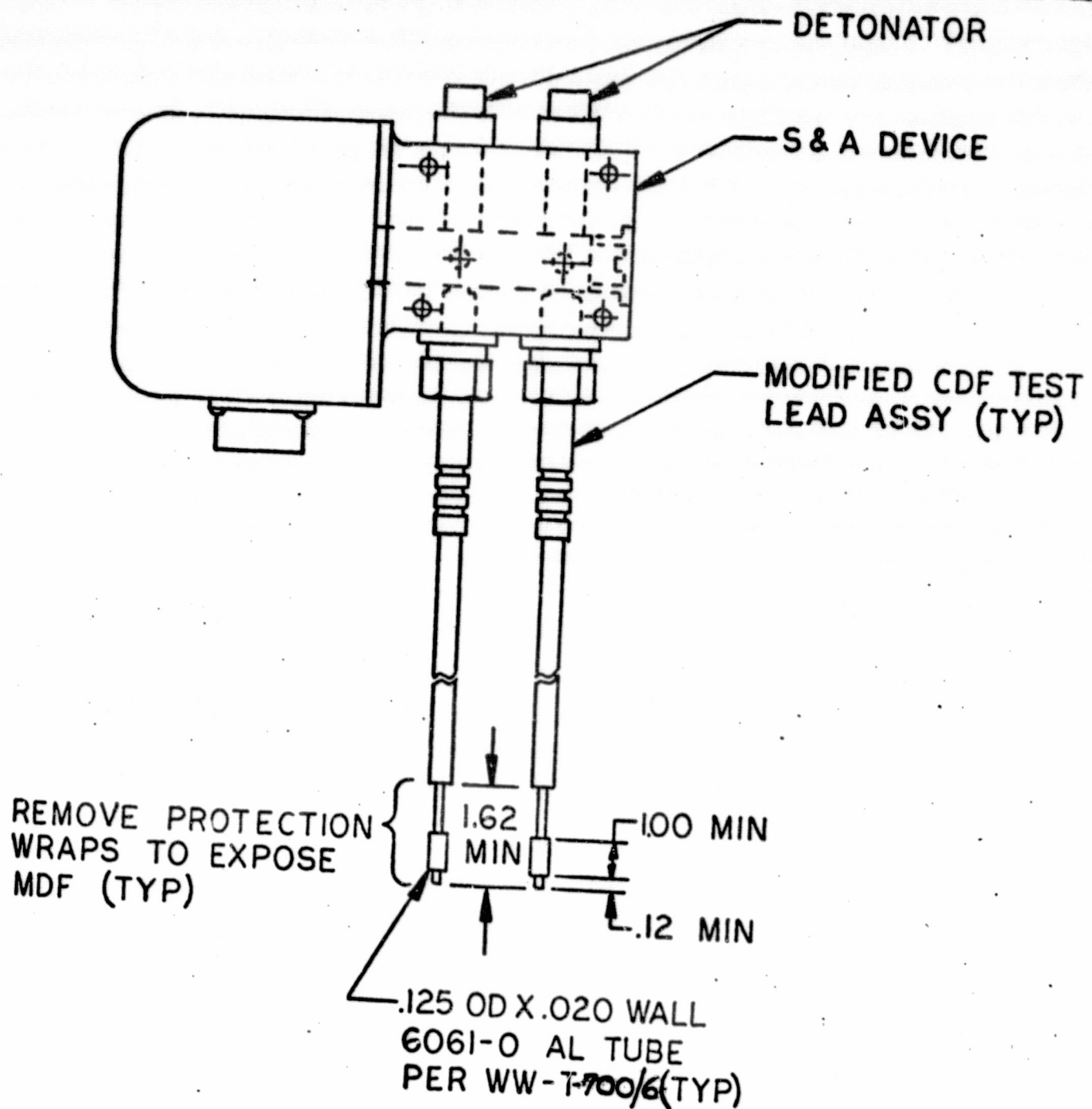


FIGURE 4
FUNCTION TEST SETUP

DID NO. _____
CDRL NO. _____
P.O. NO. _____
CONTRACT NO. NAS 8-31973

DATA MGR. FILE NO. ATP 816780
DEPT FILE NO. _____
ISSUE DATE 19 November 1977
REVISION B
SUPERSEDING A
DATE 29 July 1977

ACCEPTANCE TEST PROCEDURE
FOR
SAFETY AND ARMING DEVICE (S&A)
TMC/S PN 816780

RELEASED BY TEST
DATE 12/13/77 T.E. *Heck*

PREPARED FOR
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, ALABAMA

Teledyne McCormick Selph

3601 UNION ROAD, HOLLISTER, CALIFORNIA 95023



ATP 816780
Revision B

APPROVAL SHEET

H. Koue 10/28/77
Prepared by H. Koue
Test Engineer

H. Ghilarducci 11/18/77
Manager, Test
H. Ghilarducci

R. McDonald
Quality Engineer
R. McDonald

F. Mortela 10/28/77
Project Engineer
F. Mortela

C. Campbell 11/18/77
Program Manager
C. Campbell

K. Dixon 11/18/77
Manager, Reliability
K. Dixon

Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama
35812

IV/B

Reply to Attn of EP14(77-313)

DEC 5 1977

Teledyne McCormick Selph
Attn: Mr. R. S. Akin
3601 Union Road
P. O. Box 6
Hollister, California 95023



Subject: Contract NAS8-31973

The S&A qualification test procedure, QTP 816780, revision A, and the acceptance test procedure, ATP 816780, revision B, have been reviewed and found acceptable providing a vibration duration is added to table V of ATP 816780.

Richard L. Beck

Richard L. Beck
Contracting Officer's Representative

ORIGINAL PAGE IS
OF POOR QUALITY

INDEX OF ACTIVE SHEETS

PAGE NUMBER	REV. LTR.
Title Page	B
1	B
11	B
111	B
1	A
2	B
3	A
4	B
5	N/C
6	N/C
7	B
8	N/C
9	N/C
10	N/C
11	B
12	N/C
13	N/C
14	N/C
15	B
16	N/C
17	B
18	B

PAGE NUMBER	REV. LTR.
19	N/C
20	A
21	N/C
22	N/C
23	A
24	A
25	B
26	A
27	B
28	B
29	B
30	B
31	B
32	B
33	B
34	B
35	A
36	B
37	B
38	B
39	A
40	B

PAGE NUMBER	REV. LTR.
41	B
42	N/C
43	N/C
44	N/C
45	N/C
46	N/C

PAGE NUMBER	REV. LTR.

TABLE OF CONTENTS

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE</u>
1.0	SCOPE.	1
2.0	APPLICABLE DOCUMENTS	1
2.1	PRECEDENCE OF DOCUMENTS.	1
2.2	DOCUMENTS.	1
3.0	TEST REQUIREMENTS.	3
3.1	ACCEPTANCE TESTS	3
3.2	LOT SAMPLE PLAN.	3
4.0	QUALITY ASSURANCE PROVISIONS	5
4.1	TEST DIVISION.	5
4.2	TEST RESPONSIBILITY.	5
4.3	TEST CONDITIONS.	5
4.4	TEST EQUIPMENT	5
4.5	ACCURACY OF TEST EQUIPMENT	6
4.6	SAFETY	6
4.7	TEST REPORTING	6
4.8	TEST DATA.	6
4.9	TOLERANCE.	7
4.10	UNIT MALFUNCTION	7
5.0	NONDESTRUCT TESTS.	8
5.1	EXAMINATION OF PRODUCT	8
5.2	RADIOGRAPHIC (X-RAY) INSPECTION.	9
5.3	NEUTRON (N-RAY) INSPECTION	11
5.4	ACCEPTANCE RANDOM VIBRATION.	13
5.5	LEAK (BUBBLE TYPE) TEST.	17
5.6	TEMPERATURE ELECTRICAL CYCLE	19
5.7	AMBIENT TEMPERATURE ELECTRICAL CHECK-OUT	22
6.0	LOT SAMPLE TESTS - SAFETY & ARMING DEVICE.	27
6.1	VIBRATION.	27
6.2	TEMPERATURE HUMIDITY	32
6.3	S&A DEVICE FUNCTION TESTS.	34
7.0	EXPLOSIVE LEAD ACCEPTANCE TEST	38
7.1	LEAK TEST - EXPLOSIVE LEAD	38
7.2	EXPLOSIVE LEAD AMBIENT FIRING TEST	41

TABLE OF CONTENTS
(Continued)

<u>TABLES</u>	<u>TITLE</u>	<u>PAGE</u>
I	ACCEPTANCE TEST - S&A DEVICE	4
II	ACCEPTANCE TEST - EXPLOSIVE LEAD ASSEMBLY. . . .	4
III	ACCEPTANCE RANDOM VIBRATION (1 MIN/AXES)	15
IV	SINUSOIDAL VIBRATION	28
V	LIFT-OFF, BOOST AND REENTRY RANDOM VIBRATION . .	28

<u>FIGURES</u>		
1	VIBRATION AND SHOCK TEST SETUP	14
2	OPERATION AND ELECTRICAL TEST SETUP.	21
3	TYPICAL OSCILLOGRAPH TRACES.	25
4	FUNCTION TEST SETUP.	35
4a	FUNCTION (SAFE) TEST SET-UP.	36
5	EXPLOSIVE LEAD TEST.	39

<u>APPENDICES</u>		
A	TEST DATA SHEETS	43
	TEST DATA SHEET FOR OPERATIONAL (90° ROTATION) .	44
	CIRCUITRY CHECKS	45
	INSULATION RESISTANCE.	46
	CONTINUITY TEST.	47

ACCEPTANCE TEST PROCEDURE

1.0 SCOPE

This document defines the tests, test conditions and test procedures for acceptance testing of a Safety and Arming Device (S&A) TMC/S PN 816780 and Explosive Lead Assembly TMC/S PN 817187-1 to demonstrate compliance to National Aeronautics and Space Administration/Marshall Space Flight Center (NASA/MSFC) Specification 10A00465. (A)

2.0 APPLICABLE DOCUMENTS

2.1 PRECEDENCE OF DOCUMENTS

In the event of conflict between the requirements of this document and the specifications referenced herein, this document shall take precedence.

2.2 DOCUMENTS

The following documents of the issue and date indicated form a part of this procedure to the extent specified herein. Documents not identified herein by a revision date, letter or amendment shall be of the issue in effect by contract on date of this procedure approval.

SPECIFICATIONS

MIL-Q-9858A
16 December 1963

Requirements, Quality Program

MIL-C-45662
9 February 1962

Requirements, Calibration System

STANDARDS

MIL-STD-453 (1)
4 September 1963

Inspection, Radiographic

MIL-STD-831
28 August 1963

Test Reports, Preparation of

MIL-STD-810C
10 March 1975

Environmental Test Methods

OTHER PUBLICATIONSRockwell International Documents

MT0501-505

25 July 1975

Neutron Radiographic Inspection

TMc/S Drawings

816780

817187

Safety and Arming Device

Explosive Lead Assembly

(B)

NASA/MSFC

10A00465, Rev. C

19 July 1977

Safety and Arming Device Range Safety
System Space Shuttle Solid Rocket
Booster, Specification forNHB 5300.4 (1C)
July 1971Reliability and Quality Assurance
Publication

(B)

3.0 TEST REQUIREMENTS

3.1 ACCEPTANCE TESTS

Non-destructive and destructive acceptance tests are to be performed per Table I for S&A Devices and Table II for Explosive Leads.

3.2 LOT SAMPLE PLAN

Destructive test lot sample plan for S&A Devices and Explosive Leads shall be as follows:

<u>Lot Size*</u>	<u>Sample Size**</u>
1-90	10
91-150	10 plus 11.7% of quantity above 90
151-280	17 plus 9.2% of quantity above 150
281-500	29 plus 8.2% of quantity above 280
501-1200	47 plus 4.3% of quantity above 500
1201-3200	77 plus 2.3% of quantity above 1200

*Lot size equals sample size plus usable units.

**Fractional sample sizes below 0.5 shall be rounded downward
Fractional sample sizes 0.5 and above shall be rounded upward.

TABLE I
ACCEPTANCE TEST
S&A DEVICE

Test	Specimen	NASA 10A00465 Paragraph	TMc/S ATP 816780 Paragraph
Examination of Product	Entire Lot	4.4.2.1	5.1
Radiographic (x-ray)	Entire Lot	4.4.2.2	5.2
Radiographic (n-ray)	Entire Lot	4.4.2.2	5.3
Acceptance Vibration	Entire Lot	4.4.2.3	5.4
Leak	Entire Lot	4.4.2.4	5.5
Temperature Electrical Cycling	Entire Lot	4.3.11	5.6
Ambient Temperature Electrical Check-out	Entire Lot	4.4.2.5	5.7
Vibration	All Samples*	4.4.3.2	6.1
Temperature-Humidity	All Samples*	4.4.3.3	6.2
Ambient Temperature Electrical Checkout	All Samples*	4.4.2.5	5.7
Ambient Function ARMED	1/2 of sample*	4.4.3.4	6.3
Ambient Function SAFE	1/2 of sample*	4.4.3.5	6.3

(B)

TABLE II
ACCEPTANCE TESTS
EXPLOSIVE LEAD ASSEMBLY

Test	Specimen	TMc/S ATP 816780 Paragraph
Leak Test	Entire Lot	7.1
N-Ray	Entire lot	5.3
Ambient Function	All Samples*	7.2

*Sampling to be per paragraph 3.2 of this procedure-If sample is not divisible by two, the remainder shall be functioned in the ARMED position.

4.0

QUALITY ASSURANCE PROVISIONS

ATP 816780

4.1

TEST DIVISION

The Test Division is under the jurisdiction of the Quality Assurance Department which is directly responsible for the high standards required by TMc/S Quality Assurance Manual. All test instructions not referenced in this procedure are contained in TMc/S Quality Manual which reflects the requirements of MIL-Q-9858.

4.2

TEST RESPONSIBILITY

Unless deviations are authorized by the customer, testing will be accomplished by TMc/S in accordance with this procedure.

- a. TMc/S will use their facilities or other laboratories acceptable to the customer.
- b. Witnessing of the testing is at the discretion of NASA and/or Government Source Inspector.
- c. The customer representative shall be notified at least two days in advance of start of lot acceptance testing.

4.3

TEST CONDITIONS

Unless otherwise specified all tests shall be performed at an atmospheric pressure of between 28 and 32 inches of mercury (711.2 - 812.8mm Hg), a temperature of between +60°F and +90°F (15 - 32°C), and a relative humidity of not more than 90%.

4.4

TEST EQUIPMENT

Except when substitutions become absolutely necessary, the described test equipment shall be used. If equipment substitutions are necessary, equipment of equal or superior accuracy shall be used, as approved by the Test Supervisor.

4.5

ACCURACY OF TEST EQUIPMENT

ATP 816780

The accuracy of instruments and facility type test equipment used to control and monitor test parameters shall be calibrated periodically. The accuracy of special test equipment systems used to control and monitor test parameters shall be calibrated periodically and the period for calibration shall be less than the calibration period of the instruments contained within the special equipment system.

- a. Calibration for all measuring and test equipment shall be in accordance with TMc/S Quality Assurance Manual and MIL-C-45662.

4.6

SAFETY

TMc/S safety practices shall be followed. All test equipment and personnel shall be adequately protected and barricaded.

4.7

TEST REPORTING

A test report conforming to MIL-STD-831, shall be submitted within thirty (30) days after completion of testing at TMc/S showing the results of each test. This report shall show evidence of satisfactory completion of all testing performed on the units.

4.8

TEST DATA

All data, charts and reports generated as objective evidence of product conformance to the applicable requirements shall be retained by TMc/S.

4.9 TOLERANCE

Unless otherwise specified, the maximum allowable tolerances shall be as follows:

Temperature	$\pm 5^{\circ}\text{F}$ ($\pm 3^{\circ}\text{C}$)
Vibration Amplitude	$\pm 10\%$
Vibration Frequency	$\pm 2\%$ or $1/2$ Hz below 20 Hz
Vibration Duration	$+ 10\%$ -0%
Vibration Composite RMS	$\pm 10\%$

(B)

4.10 UNIT MALFUNCTION

A unit which does not meet the requirements of the nondestructive tests shall be rejected on an individual basis; however, the unit may be reworked, if possible, and retested. If the unit passes the retest, it may be re-instated in the lot.

5.0

NONDESTRUCT TESTS

ATP 816780

5.1

EXAMINATION OF PRODUCT

5.1.1

Reference

- a. TMc/S Drawing 816780.

5.1.2

Number of Components (See Tables I & II)

100% of entire lot of S&A Devices and Explosive Leads.

5.1.3

Test Requirement

All units shall be carefully examined to verify critical dimensions, quality of workmanship, use of proper materials and finishes, and visible defects per TMc/S drawing 816780.

5.1.4

Evaluation

Examination shall be conducted, evaluated, and certified by TMc/S Inspection personnel.

5.2 RADIOGRAPHIC (X-RAY) INSPECTION

5.2.1 Reference

- a. NASA Specification 10A00465, paragraph 4.4.2.2.
- b. MIL-STD-453.

5.2.2 Number of Units

100% of the lot of S&A Devices only.

5.2.3 Test Requirements

All devices shall be X-rayed in accordance with MIL-STD-453. Devices with defects or imperfections shall be rejected. Each device shall be X-rayed in two views, with views 90° to 120° apart along the longitudinal axis. Two negatives shall be made of each view. One set shall be maintained in a permanent file by TMc/S. The second set shall be submitted with the lot acceptance data package.

5.2.4 Test Equipment

The radiographic equipment used shall be per MIL-STD-453.

5.2.5 Evaluation

Radiographic records shall be examined by qualified personnel to see that they are properly identified and that the quality and clarity of the radiograph permits inspection of the internal components of the assembly. The inspector shall ascertain that certifications are present and are complete.

The following conditions are considered defects:

- a. Missing, partial, and unconsolidated charges.
- b. Voids and gaps in and between charges.
- c. Charge density variations.
- d. Internal foreign material located in charges, flash holes, etc. (Material and size should be identified to determine resolution capabilities.)
- e. Out-of-position charges and components.
- f. Presence of manufacturing liquids and materials.
- g. Missing components such as o-rings, spacers, and washers.
- h. Excess materials such as solder, flux and adhesive.

5.3 NEUTRON (N-RAY INSPECTION)

5.3.1 Reference

- a. NASA Specification 10A00465, paragraph 4.4.2.2.2.
- b. RIC Specification MT0501-505.

5.3.2 Units To Be Tested

(B)

100% of the lot of S&A Devices and Explosive Leads.

5.3.3 Test Requirement

Each S&A device and explosive lead shall be subjected to neutron radiographic examination in accordance with MT0501-505. The specific accept/reject criteria shall be approved by MSFC. One copy of the radiograph is to be maintained in a permanent file by TMc/S. The original neutron radiograph negative shall be submitted with the lot acceptance data package.

5.3.4 Evaluation

Radiographic records shall be examined by qualified personnel to see that they are properly identified and that the quality and clarity of the radiograph permits inspection of the internal components of the assembly. The inspector shall ascertain that certifications are present and are complete.

The following conditions are considered defects:

- a. Missing, partial, and unconsolidated charges.
- b. Voids and gaps in and between charges.

5.3.4 Evaluation (Continued)

- c. Charge density variations.
- d. Internal foreign material located in charges, flash holes, etc. (Material and size should be identified to determine resolution capabilities.)
- e. Out-of-position charges and components.
- f. Presence of manufacturing liquids and materials.
- g. Missing components such as o-rings, spacers, and washers.
- h. Excess materials such as solder, flux, and adhesive.

5.4 ACCEPTANCE RANDOM VIBRATION

5.4.1 Reference

- a. NASA Specification 10A00465, paragraph 4.4.2.3.
- b. MIL-STD-810.

5.4.2 Units To Be Tested

100% of the lot of S&A devices only.

5.4.3 Test Equipment

A list of the test equipment used will be in the test report provided by the outside test laboratory conducting the Random Vibration Test.

5.4.4 Test Requirements

Each unit shall be mounted onto the vibration table as shown in Figure 1. Subject each unit to the vibration levels and duration shown in Table III. The specified levels of Table III shall be applied for a period of one (1) minute per axis with the unit in the ARMED position. All testing shall be at laboratory ambient conditions. The switch position shall be monitored during the test. After each axis of vibration the device shall be cycled from SAFE to ARMED to SAFE. The elapsed time for 90° rotation shall not exceed 250 milli-seconds. All test tolerances shall be per MIL-STD-810 except the lower spectral density tolerance shall be minus 30 percent.

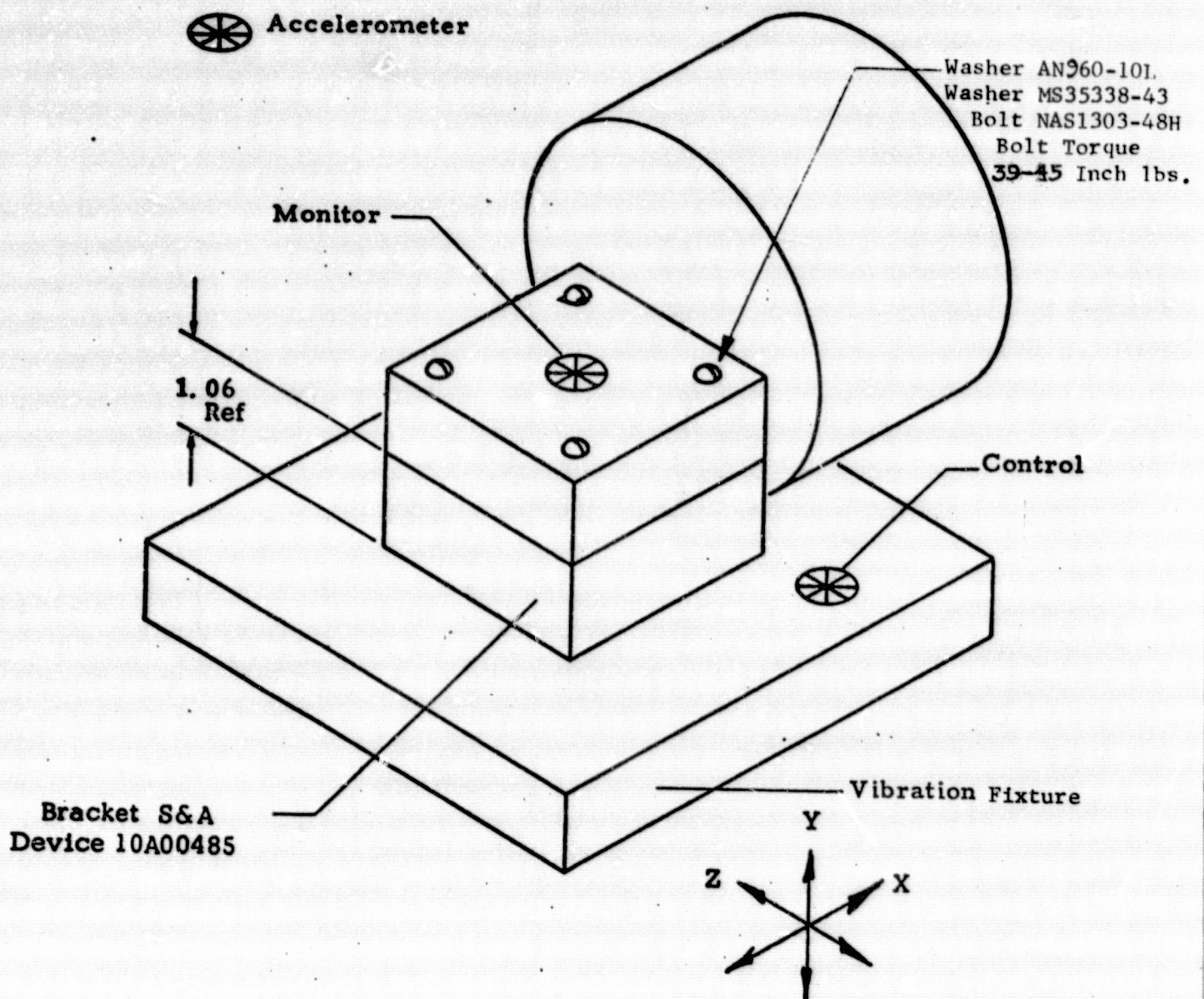


FIGURE 1
VIBRATION AND SHOCK TEST SETUP

TABLE III
ACCEPTANCE RANDOM VIBRATION (1MIN/AXES)

Y AXIS		X AND Z AXES	
20 -	20 Hz @ 0.047 g ² /Hz	20 -	20 Hz @ 0.10 g ² /Hz
30 -	30 Hz @ +3 dB/oct	40 -	40 Hz @ +3 dB/oct
53 -	53 Hz @ 0.070 g ² /Hz	135 -	135 Hz @ 0.020 g ² /Hz
100 -	100 Hz @ +6 dB/oct	250 -	250 Hz @ +3 dB/oct
170 -	170 Hz @ 0.25 g ² /Hz	440 -	440 Hz @ 0.037 g ² /Hz
	2000 Hz @ -3 dB/oct	500 -	500 Hz @ +9 dB/oct
	2000 Hz @ 0.022 g ² /Hz	1100 -	1100 Hz @ 0.055 g ² /Hz
			2000 Hz @ -6 dB/oct
			2000 Hz @ 0.017 g ² /Hz

Composite = 11.4 grms Composite = 8.7 grms

Note: All tolerances per MIL-STD-810 except the lower spectral density tolerance shall be minus 30 percent.

5.4.5 Test Procedure

- Attach the unit to the vibration fixture as shown in Figure 1 and record bolt torque value.
- Attach a control accelerometer to the vibration fixture and a monitor accelerometer to each test specimen as shown in Figure 1. Each monitoring accelerometer output shall be recorded on an oscillograph or X-Y plotter.
- Test conditions are laboratory ambient.
- Perform an equalization run prior to the actual test.
- Vibration shall be applied along the three (3) mutually perpendicular axes of the unit as shown in Figure 1.
- Place the unit in the ARMED position and vibrate at the levels specified in Table III for one (1) minute per axis.
- Record all power spectral density levels.
- Cycle the unit from SAFE to ARM to SAFE with 28 V.D.C. after completion of each axis of vibration.
- Record number of cycles and elapsed time for 90° rotation.
- Monitor the S&A switches during vibration of indication of rotor rotation greater than 7.5°.

NOTE: Rotor Rotation greater than 7.5° is indicated when ARM circuits indicates an "OPEN" condition and the SAFE circuit indicates a "CLOSED" condition.

5.4 VIBRATION (Continued)

5.4.5 Test Procedure (Continued)

A test report shall be prepared and shall contain the following information, as a minimum:

- a. Part number
- b. Serial numbers
- c. Test equipment used
- d. Chronological history of the test
- e. Power spectral density plots of fixture evaluation in each axis.
- f. Power spectral density plots of the test in each axis
- g. Record of condition of each unit following completion of test.

5.4.6 Evaluation

- a. No visible damage shall be observed.
- b. There shall be no rotor rotation greater than 7.5° .
- c. The elapsed time for 90° rotation shall not exceed 250 milliseconds and the switches properly indicate rotor position.
- d. Subject both units to the leakage test (paragraph 5.5) upon completion of random vibration and to the remaining tests listed in Table I.

5.5 LEAK (BUBBLE TYPE) TEST5.5.1 Reference

- a. NASA Specification 10A00465, paragraph 4.4.2.4.

5.5.2 Units To Be Tested

100% of the lot of S&A devices only.

5.5.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib. Interval</u>
Pressure Chamber	TMc/S	N/A	N/A	N/A
Vacuum Gauge	Matheson	30	± 0.5 in. Hg	3 Months
Vacuum Pump	Cenco	Megavac	N/A	N/A

5.5.4 Test Requirement

The test specimen shall have zero leakage for two (2) minutes at one (1) psia pressure (61,000 ft. altitude equivalent).

5.5.5 Procedure

- a. Fill the transparent pressure vessel with distilled water so that when the vessel is in the test position the units will be immersed at least one (1) inch, but not more than five (5) inches below the water.
- b. Attach the unit(s) to the elevated platform of the pressure vessel with the vacuum chamber rotated in the "no-test" position (unit(s) above water level).
- c. Seal the vacuum chamber and reduce the air pressure above the water to 0.5 inch of mercury (in. Hg) for at least two (2) minutes to boil off trapped air in the water, then vent the chamber back to atmospheric condition.

(B)

5.5.5 Procedure *Continued)

- d. Reseal the chamber and rotate it to the test position.
- e. Reduce the pressure of the air space above the liquid to two (2) in. Hg absolute, and hold constant during the observation period of two (2) minutes.

NOTE: A steady stream or recurring succession of small bubbles from the unit indicates leakage.

- f. Rotate the chamber to the "no-test" position and then allow the air pressure above the liquid to return to laboratory atmospheric.
- g. Remove the unit(s) from the vessel and remove its surface liquid by blowing, blotting or air drying.

5.5.6 Acceptance Criteria

There shall be no leakage as evidenced by a continuous stream of bubbles being emitted from the test specimen.

NOTE: Bubbles which are the result of entrapped air on the exterior parts of the case shall not be considered as leaks.

(B)

5.6 TEMPERATURE ELECTRICAL CYCLE

5.6.1 Reference

- a. NASA Specification 10A00465, paragraph 4.3.11.

5.6.2 Units To Be Tested

100% of the lot of S&A devices only.

5.6.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib. Interval</u>
Temperature Chamber	Messimers	FT-4	N/A	N/A
Temperature Recorder	Honeywell	31F1	$\pm 2^{\circ}\text{F}$	3 Months
D.C. Power Supply	Perkins	TVCR-040-5	N/A	N/A
Function Monitor	Douglas	SA 1077-1	$\pm 1\%$	3 Months
Oscillograph	Honeywell	906	N/A	N/A
Cable	Douglas	SA 1077-3	N/A	N/A

5.6.4 Test Requirement

Cycle the unit from SAFE to ARMED to SAFE four (4) times each at voltage inputs of 24 vdc, 28 vdc, and 32 vdc. The current required to actuate the solenoid or motor shall be monitored and recorded with each application of power. Elapsed time for 90° rotation shall not exceed 250 milliseconds. The above test shall be conducted as specified while the unit is stabilized at +165°F and then repeated again while the unit is stabilized at +20°F. NOTE: Sequence is optional. The +20°F cycling may be performed before the +165°F cycling.

5.6.5 Test Procedure

Note: Install an MS3181-14 protective cap on all units before exposing to +20°F.

- Step 1. Place units into the temperature conditioning chamber and stabilize units at $+20 \pm 5^{\circ}\text{F}$.

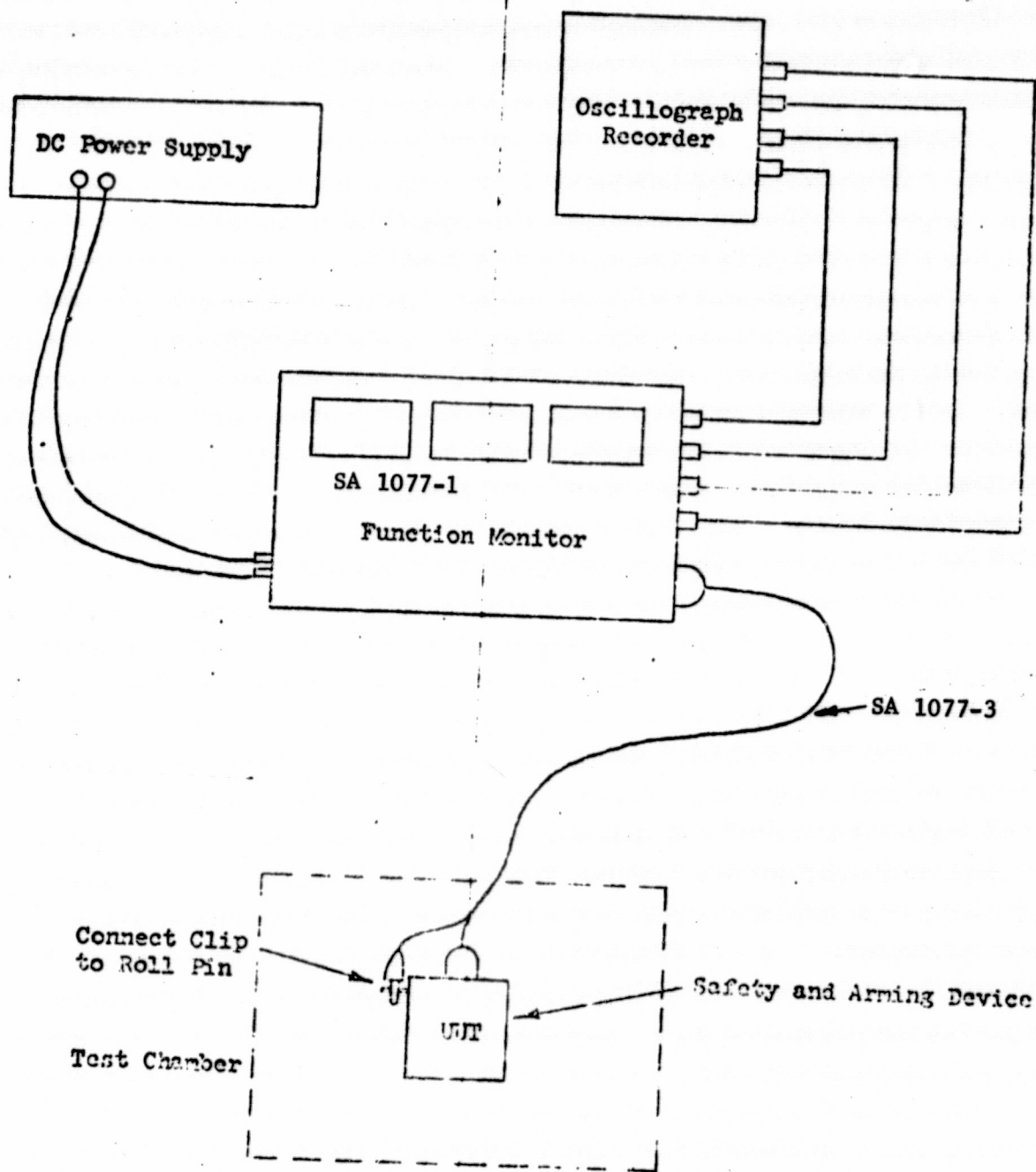
5.6.5 Test Procedure (Continued)

- Step 2. Set-up electrical test set-up per Figure 2 with the D. C. Power supply off.
- Step 3. Observe polarity when connecting power supply to function monitor.
- Step 4. Place the function monitor 28 volt switch to "on" and the contact selector switch to "off".
- Step 5. Hold the load switch in the LOW TEMP position and adjust the power supply for an indication of three (3) amperes on the function monitor current meter.
- Step 6. Adjust the galvanometer signals as follows:
Hold the load switch in the LOW TEMP position
adjust the recorder deflection for fifteen lines.
- Step 7. Set-up oscillograph recorder paper speed to 10 in/sec.
CAUTION: The Safety and Arming Device shall be in the SAFE position when received. Upon completion of check-out, it shall be returned to the SAFE position. The voltage applied to the solenoid shall not exceed 32 vdc.
- Step 8. Hold the load switch in the AMB TEMP position and adjust the power supply for an indication of 32 volts (A) on the function monitor current meter.
- Step 9. Cycle the unit from SAFE to ARM to SAFE four (4) times while running the oscillograph recorder.
- Step 10. Repeat steps (8) and (9) at 28 VDC and 24 VDC.
- Step 11. Check oscillograph recording from actuation tests, verify actuation time for 90° rotation did not exceed 250 milliseconds or current never exceeds 3 amps.
- Step 12. Record all test results on operational test data sheet.
- Step 13. Repeat Steps (1) thru (12) with units stabilized at $165 \pm 5^{\circ}\text{F}$.

5.6.6 Evaluation

- a. The elapsed time for 90° rotation shall not exceed 250 ms.
- b. The actuation current shall not exceed 3 amps.

OPERATIONAL AND ELECTRICAL TEST SET-UP
FIGURE 2



ORIGINAL PAGE IS
OF POOR QUALITY

5.7 AMBIENT TEMPERATURE ELECTRICAL CHECK-OUT

5.7.1 Reference

- a. NASA Specification 10A00465, paragraph 4.4.2.5.

5.7.2 Units To Be Tested

100% of the lot of S&A devices only.

5.7.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib. Interval</u>
Megohmmeter	Freed	1620	$\pm 5\%$	3 Months
D.C. Power Supply	Perkins	TVCR-040-5	N/A	N/A
Function Monitor	Douglas	SA 1077-1	N/A	N/A
Cable	Douglas	SA 1077-3	N/A	N/A
Oscillograph	Honeywell	906	N/A	N/A
Resistance Circuit Tester	Alinco	101-5AF	$\pm 1\%$ rdg.	3 Months
Volt-Ohmmeter	Simpson	360	$\pm 5\%$	3 Months

5.7.4 Test Requirement

Perform all electrical check-outs at standard laboratory ambient test conditions. Cycle the S&A device from SAFE to ARMED to SAFE four (4) times each at voltage inputs of 24 Vdc, 28 Vdc, and 32 Vdc. The current required to actuate the solenoid or motor shall be monitored and recorded with each application of power. Elapsed time for 90° rotation shall not exceed 250 milliseconds.

5.7.5 Test Procedure

5.7.5.1 Ninety (90) Degree Rotation Test

Perform this test the same as 5.6.5, Steps 2 through 12 except the test temperature is room ambient.

5.7.5.2 Circuitry Check Tests

5.7.5.2.1 CalibrationSTEP:

1. Place the function monitor contact selector to TARE VOLTAGE with the S&A unit in the SAFE position.
2. Verify the CONTACT TEST light is "ON" and adjust the power supply for 2.5 ± 0.05 amperes on the CURRENT meter.
3. Press the CONTACT TEST switch and read the voltage drop on the contact voltage drop meter.

NOTES: a) Record the TARE VOLTAGE and subtract this value from each of the subsequent readings eliminate any error induced by the test set-up.

b) Each reading after subtracting the tare voltage shall not exceed 750 millivolts.

(A)

5.7.5.2.2 Contact TestSTEP:

1. Place the CONTACT SELECTOR in the G-H, K-N, P-R, S-T, F-m, and V-CASE positions.
2. Press the CONTACT TEST button and read the voltage on the CONTACT VOLTAGE DROP meter and record test results on test data sheet (Figure 5).
3. Place the CONTACT SELECTOR to J-H, K-L, R-N, and T-U positions. In each position the CONTACT TEST light should remain "OFF" indicating an open circuit.
4. Place the CONTACT SELECTOR switch to "OFF".
5. Actuate the unit to the ARMED position.

5.7.5.2.2 Contact Test (Continued)

6. Place the CONTACT SELECTOR in the J-h, K-L, R-N, and T-U positions.
7. Press the CONTACT TEST button and read the voltage on the CONTACT VOLTAGE DROP meter and record test results on test data sheet.
8. Place the CONTACT SELECTOR to G-H, K-N, P-R, and S-T positions. In each position the CONTACT TEST light should remain "OFF" indicating an open circuit.
9. Place the CONTACT SELECTOR TO "OFF".
10. Return the unit to SAFE position.
11. Reduce the power supply voltage to zero.

5.7.5.2.3 Solenoid Resistance TestSTEP:

1. Connect the Alinco resistance circuit tester to the function (A) monitor, + to binding post N and - to binding post M.
2. Measure and record the solenoid resistance on test data sheet.

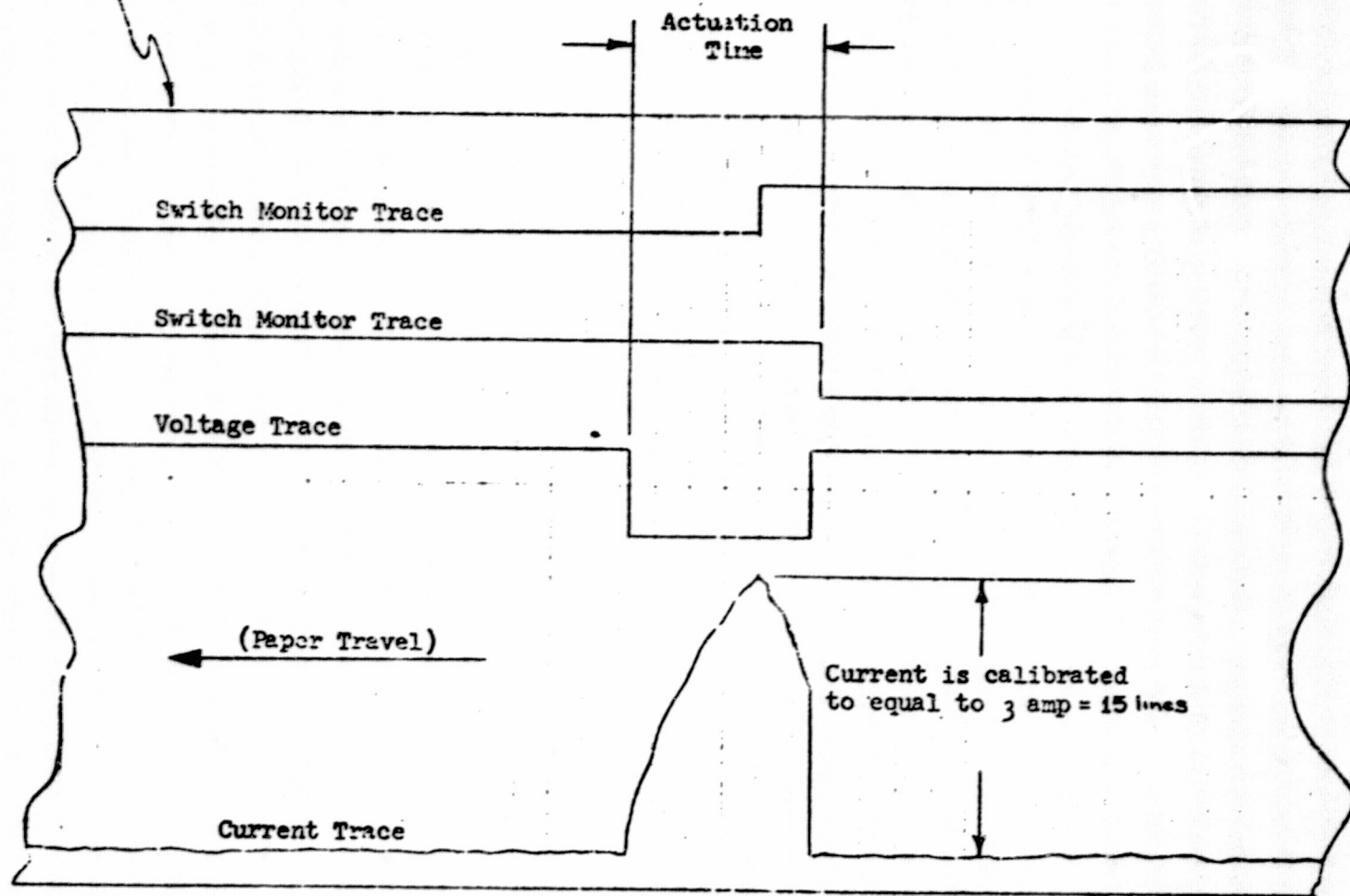
NOTE: The solenoid resistance as measured on the resistance circuit tester shall be 10.52 to 11.72 ohms.

3. Disconnect the circuit tester.

5.7.5.2.4 Insulation Resistance TestsSTEP:

1. Disconnect the power supply from the function monitor.
2. Adjust Megohmmeter's test voltage to 500 vdc.
3. Connect Megohmmeters negative lead to the CASE binding post on the function monitor.
4. Using the Megohmmeter positive lead check the insulation resistance between the following pins and the case: F, G, H, J, K, L, M, N, P, R, S, T and U.
5. Record insulation resistance on test data sheet.

Timing Lines - at 100 pulses (lines) per second the time between lines is 10 milliseconds.



TYPICAL OSCILLOGRAPH TRACES

FIGURE 3

- NOTES: 1) Actuation time is measured between the start of voltage application and the last switch monitor activation.
2) Polarity of the traces is not important.

(B)

ATP 816780

5.7.5.2.5 Continuity Test

ATP 816780

STEP:

1. Place the rotor in the SAFE position.
2. Verify, using an ohmmeter, that an open circuit exists between the following pins:
V-A V-D V-G V-K V-N V-S
V-B V-E V-H V-L V-P V-T
V-C V-F V-J V-M V-R V-U
3. Record results on the continuity test data sheet.

(A)

6.0 LOT SAMPLE TESTS - SAFETY & ARMING DEVICE6.1 VIBRATION6.1.1 Reference

- a. NASA Specification 10A00465, paragraph 4.3.6.
- b. MIL-STD-810.

6.1.2 Units to be Tested - See paragraph 3.2 of this procedure.6.1.3 Test Equipment

A list of the test equipment used will be in the test report provided by the outside test laboratory conducting the vibration test.

6.1.4 Test Requirements6.1.4.1 Sinusoidal Vibration

Each unit shall be mounted onto the vibration table as shown in Figure 1. Subject each unit to the vibration levels and duration shown in Table II. The specified levels shall be applied at laboratory ambient condition with the unit in the ARMED position. One sweep shall be performed in all three mutually perpendicular axes of the unit. The sweep rate shall be 3.0 octaves per minute. The switch position shall be monitored during the test. After each axis of vibration, the unit shall be rotated from ARM to SAFE to ARM. The elapsed time for each 90 degrees rotation shall not exceed 250 milliseconds.

(B)

6.1.4.2 Random Vibration

Each unit shall be vibrated to the levels specified in Table V for the duration shown in Table V. The lift-off and boost random levels shall be applied with the unit in the ARMED position. The re-entry random vibration level shall be applied with the unit in the SAFE position. All testing shall be at laboratory ambient conditions. The switch position shall be monitored during the test. After each axis of vibration the device shall be cycled from SAFE to ARMED to SAFE. The elapsed time for 90° rotation shall not exceed 250 milliseconds and actuation current shall not exceed 3.0 amperes. All test tolerances shall be per MIL-STD-810 except the lower spectral density tolerance shall be minus 30 percent.

TABLE IV
SINUSOIDAL VIBRATION

<u>Rate</u>	<u>Frequency (Hz)</u>	<u>Level</u>
Three (3)	3.0 - 8.5	0.80 in. d.a.
Octaves per	8.5 - 35.0	3.0 g's peak
Minute	35.0 - 50.0	1.0 g peak

(B)

NOTE: Test tolerances per MIL-STD-810.

TABLE V
LIFT-OFF, BOOST AND REENTRY RANDOM VIBRATION

1. Lift-off Random Vibration Criteria (a) Test duration: 60 sec/axis

<u>Y AXIS (ARMED POSITION)</u>	<u>X AND Z AXES (ARMED POSITION)</u>
20 Hz @ 0.075 g ² /Hz	20 Hz @ 0.040 g ² /Hz
20 - 40 Hz @ +3 dB/Oct.	30 - 40 Hz @ +3 dB/Oct.
40 - 54 Hz @ 0.15 g ² /Hz	40 - 280 Hz @ 0.08 g ² /Hz
54 - 100 Hz @ +9 dB/Oct.	280 - 400 Hz @ +6 dB/Oct.
100 - 170 Hz @ 0.95 g ² /Hz	400 - 800 Hz @ 0.16 g ² /Hz
170 - 2000 Hz @ -3 dB/Oct.	800 - 2000 Hz @ -6 dB/Oct.
2000 Hz @ 0.082 g ² /Hz	2000 Hz @ 0.026 g ² /Hz
Composite - 22.2 grms	Composite - 13.2 grms

TABLE V - Continued

2. Boost Random Vibration Criteria (b) Test duration: 120 sec/axis

Y AXIS (ARMED POSITION)		X AND Z AXES (ARMED POSITION)	
	20 Hz @ $0.19 \text{ g}^2/\text{Hz}$		20 Hz @ $0.040 \text{ g}^2/\text{Hz}$
20 -	30 Hz @ +3 dB/Oct.	20 -	40 Hz @ +3 dB/Oct
30 -	53 Hz @ $0.28 \text{ g}^2/\text{Hz}$	40 -	135 Hz @ $0.080 \text{ g}^2/\text{Hz}$
53 -	100 Hz @ +6 dB/Oct.	135 -	250 Hz @ +3 dB/Oct.
100 -	170 Hz @ $1.0 \text{ g}^2/\text{Hz}$	250 -	440 Hz @ $0.15 \text{ g}^2/\text{Hz}$
170 -	2000 Hz @ -3 dB/Oct.	440 -	500 Hz @ +9 dB/Oct.
	2000 Hz @ $0.09 \text{ g}^2/\text{Hz}$	500 -	1100 Hz @ $0.22 \text{ g}^2/\text{Hz}$
		1100 -	2000 Hz @ -6 dB/Oct
			2000 Hz @ $0.067 \text{ g}^2/\text{Hz}$
Composite = 22.9 grms		Composite = 17.4 grms	

3. Reentry Random Vibration Criteria (c) Test Duration: 90 sec/axis

Y AXIS (SAFE POSITION)		X AND Z AXES (SAFE POSITION)	
	20 Hz @ $0.50 \text{ g}^2/\text{Hz}$	20 -	40 Hz @ $0.75 \text{ g}^2/\text{Hz}$
20 -	40 Hz @ +3 dB/Oct.	40 -	50 Hz @ -12 dB/Oct.
40 -	60 Hz @ $1.00 \text{ g}^2/\text{Hz}$	60 -	400 Hz @ $0.13 \text{ g}^2/\text{Hz}$
60 -	75 Hz @ -12 dB/Oct.	400 -	2000 Hz @ -3 dB/Oct.
75 -	230 Hz @ $0.36 \text{ g}^2/\text{Hz}$		2000 Hz @ $0.026 \text{ g}^2/\text{Hz}$
230 -	500 Hz @ -12 dB/Oct.		
500 -	1000 Hz @ $0.017 \text{ g}^2/\text{Hz}$		
1000 -	2000 Hz @ -6 dB/Oct.		
	2000 Hz @ $0.0042 \text{ g}^2/\text{Hz}$		
Composite - 11.9 grms		Composite - 12.2 grms	

(B)

6.1.5 Test Procedure

6.1.5.1 Sinusoidal Vibration

- a. Attach the unit to the vibration fixture as shown in Figure 1 and record bolt torque value. Connect the monitor switch position indicator module to the electrical connector of the device.
- b. Attach a control accelerometer to the vibration fixture and a monitor accelerometer to each test specimen as shown in Figure 1. All accelerometer outputs shall be recorded on an oscillograph or X-Y plotter.
- c. Test conditions are laboratory ambient.
- d. Take a typical photograph (axis optional) of the test set-up.
- e. Place the device in the ARMED position.
- f. Subject each unit to sinusoidal vibration at levels specified in Table IV and in each of the three mutually perpendicular axes of the unit as shown in Figure 1 and observe the monitor switch position indicator during the test.
- g. Cycle the unit from ARM to SAFE to ARM after completion of each axis of vibration. Cycling shall be performed per paragraph 5.7.5.1 of this procedure except that only the 28 volt test shall be performed.
- h. Record number of cycles and elapsed time for each 90 degree rotation.
- i. Monitor the S&A switches during vibration for indication of rotor rotation greater than 7.5°.

(B)

6.1.5.2 Random Vibration

- a. Attach the unit to the vibration fixture as shown in Figure 1.
- b. Attach a control accelerometer to the vibration fixture and a monitor accelerometer to each test specimen as shown in Figure 1. All accelerometer outputs shall be recorded on an oscillograph or X-Y plotter.

6.1.5.2 Random Vibration (Continued)

- c. Connect the monitor switch position indicator module to the electrical connector of the device.
- d. Test conditions are laboratory ambient.
- e. Perform an equilization run prior to the actual test.
- f. Vibration shall be applied along the three (3) mutually perpendicular axes of the unit as shown in Figure 1. Observe the monitor switch position indicator during all vibration tests. .
- g. Place the unit in the ARMED Position and vibrate at the lift-off levels specified in Table V for the time duration specified.
- h. Vibrate the unit at the boost levels specified in Table V for the time duration specified.
- i. Place the unit in the SAFE position and vibrate at the reentry levels specified in Table V for the time duration specified.
- j. Record all power spectral density levels.
- k. Cycle the unit from SAFE to ARM to SAFE after completion of each axis of vibration. Cycling shall be performed per paragraph 5.7.5.1 of this procedure except that only 28 volts cycling shall be performed.
- l. Record number of cycles and elapsed time for 90 degree rotation.

(B)

6.1.6 Evaluation

- a. No visible damage shall be observed.
- b. There shall be no rotor rotation greater than 7.5° as indicated by the monitor switch position indicator.
- c. The elapsed time for 90° rotation shall not exceed 250 milliseconds, the actuation current shall not exceed 3.0 amperes, and the switches properly indicate rotor position.
- d. Subject units to the remaining tests listed in Table I.

6.2

TEMPERATURE HUMIDITY

ATP 816780

6.2.1

References

- a. NASA Specification 10A00465, paragraph 4.4.3.2.
- b. MIL-STD-810B, Method 507, Procedure 1.

6.2.2

Units To Be Tested (See Paragraph 3.2)

6.2.3

Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib. Interval</u>
Humidity Chamber Recorder	Tenny	TH-27	$\pm 2^{\circ}\text{F}$	3 Months
pH Tester Block	Bristols	43B	$\pm 2^{\circ}\text{F}$	3 Months
Type Comparator	La Motte	6.00- 7.40	± 0.1 ph unit	Annually

6.2.4

Test Requirements

Humidity test per MIL-STD-810, Method 507.1, Procedure I, is applicable except that the unit will be non-operating. There shall be no evidence of corrosion, peeling, chipping or blistering of the assembly finish.

(B)

6.2.5

Test Procedure

NOTE 1 - When unit is set up in the chamber, have a typical photograph taken.

NOTE 2 - Steam, or distilled, demineralized, or deionized water having a pH value between 6.0 and 7.2 at 73°F shall be used to obtain the specific humidity and this shall be verified prior to test start using a pH Tester Block Type Comparator.

6.2.5 Test Procedure (Continued)

- a. Place samples with sealing plugs installed in a temperature chamber which has been preconditioned between 59°F and 91°F with uncontrolled humidity.
- b. Raise temperature chamber to 160°F and humidity to 95% over a period of two (2) hours.
- c. The samples shall be maintained at 160°F, 95% humidity for not less than six (6) hours.
- d. With humidity maintained at 85% or greater, gradually reduce temperature to 82°F over a period of not less than 16 hours. This constitutes one (1) cycle.
- e. The number of continuous cycles shall be ten (10) for a total test time of not less than 240 hours.
- f. Upon completion of humidity cycling the samples may be wiped dry.

(B)

6.2.6 Evaluation

- a. There shall be no evidence of corrosion, peeling, chipping or blistering of the assembly.
- b. Subject the units to the remaining sample tests listed in Table I.

6.3 S&A DEVICE FUNCTION TESTS

ATP 816780

6.3.1 Reference

- a. NASA Specification 10A00465, paragraphs 4.4.3.4/4.4.3.5. (B)

6.3.2 Units To Be Tested (See Paragraph 3.2)

One-half samples function in the ambient ARMED position.

One-half samples function in the ambient SAFE position.

NOTE: If sample is not divisible by two, the remainder shall be functioned in the ARMED position. (B)

6.3.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	
Detonator	-----	ME453-0021-0009	CFM
CDF	-----	10A00455	CFM
Al. Tubing	N/A	6061-0	.125 OD x .020 wall
Firing Unit	NASA	C72-0833	CFM
Debris Shield	NASA	10A00487	-----

6.3.4 Test Requirements

Function one-half of the test samples in the ARMED position and the remaining one-half of the test sample in the SAFE position. The test set-up shall be per Figure 4.

6.3.5 Test Procedure (See Figure 4)

- a. Torque the two NSI detonators into each S&A device as 115-120 inch-pounds.
- b. Assemble the S&A device with the 10A00485 bracket to the mounting plate per Figure 4a. Install the 10A00487 debris shield for the "SAFE" tests only. (B)

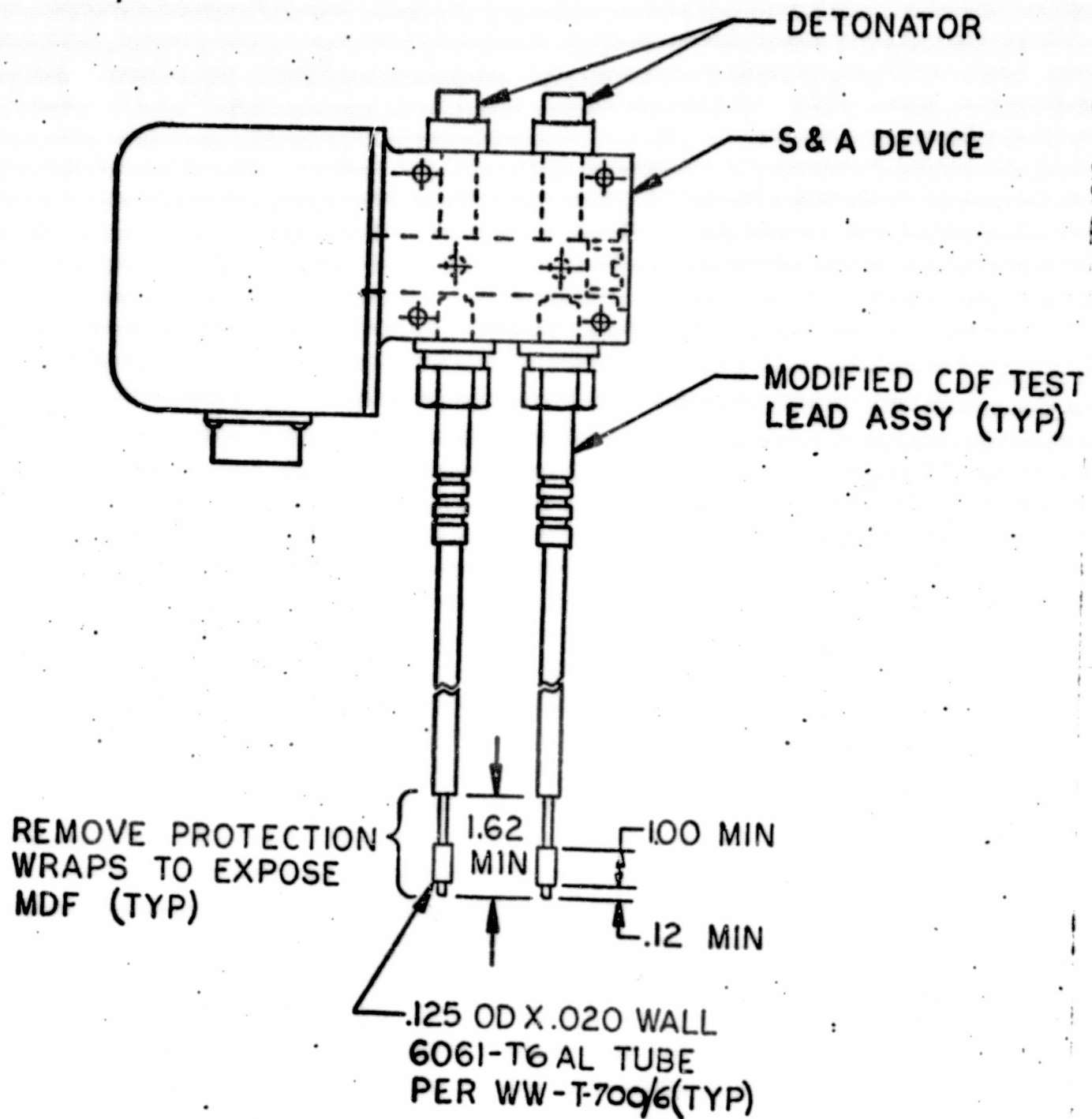
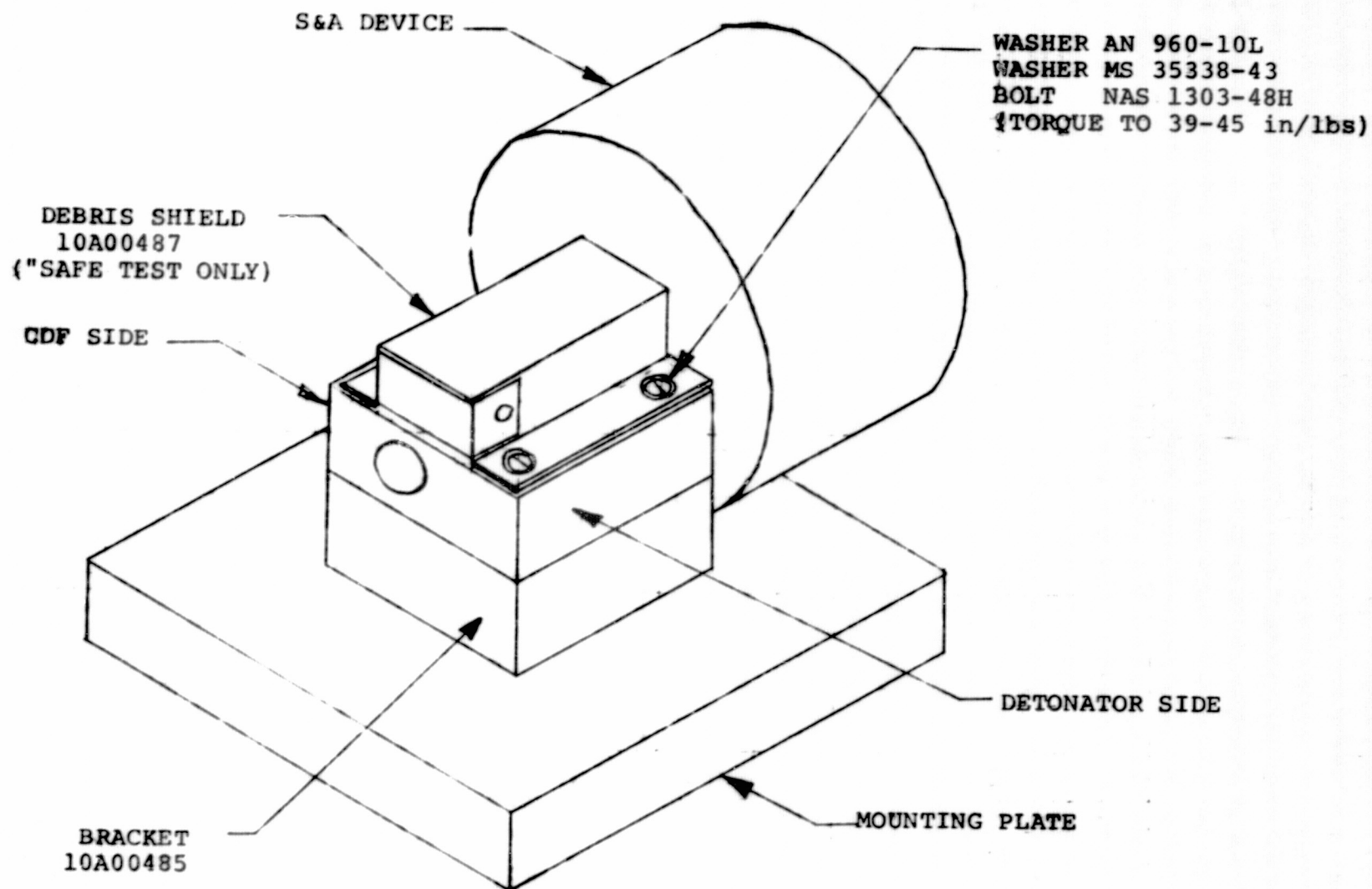


FIGURE 4
FUNCTION TEST SETUP



(B)

FIGURE 4A

FUNCTION (SAFE) TEST SET-UP

6.3.5 Test Procedure (Continued)

- c. Torque the CDF test lead assemblies into each S&A device at 60-90 inch-pounds.
- d. Remove the protective wrap from each CDF assembly to expose at least 1.62 inches of MDF.
- e. Install the 6061-0 aluminum tube over each section of MDF as shown in Figure 4.
- f. Place the unit in either the ARMED or SAFE position (see paragraph 6.3.4).
- g. Initiate each NSI detonator by the NASA firing unit. (A)

6.3.6 Evaluation

- a. "ARMED" Function Test: The aluminum sleeve on each CDF test lead assembly shall be completely ruptured to indicate satisfactory operation of the test specimen.
- b. "SAFE" Function Test: There shall be no fragmentation of the S&A body or rotor. Satisfactory operation shall be indicated by no chemical decomposition of the test lead explosive. (B)

7.0 EXPLOSIVE LEAD ACCEPTANCE TEST

(B)

7.1 LEAK TEST - EXPLOSIVE LEAD7.1.1 Units To Be Tested

One hundred percent (100%) of the explosive leads in the lot.

7.1.2 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib. Interval</u>
Leak Detector	Veeco	MS-9 or 17	$\pm 1/2$ decade	Each lot
Leak Standard	Veeco	SC4	$\pm 1/2$ decade	Replace Every 5 years

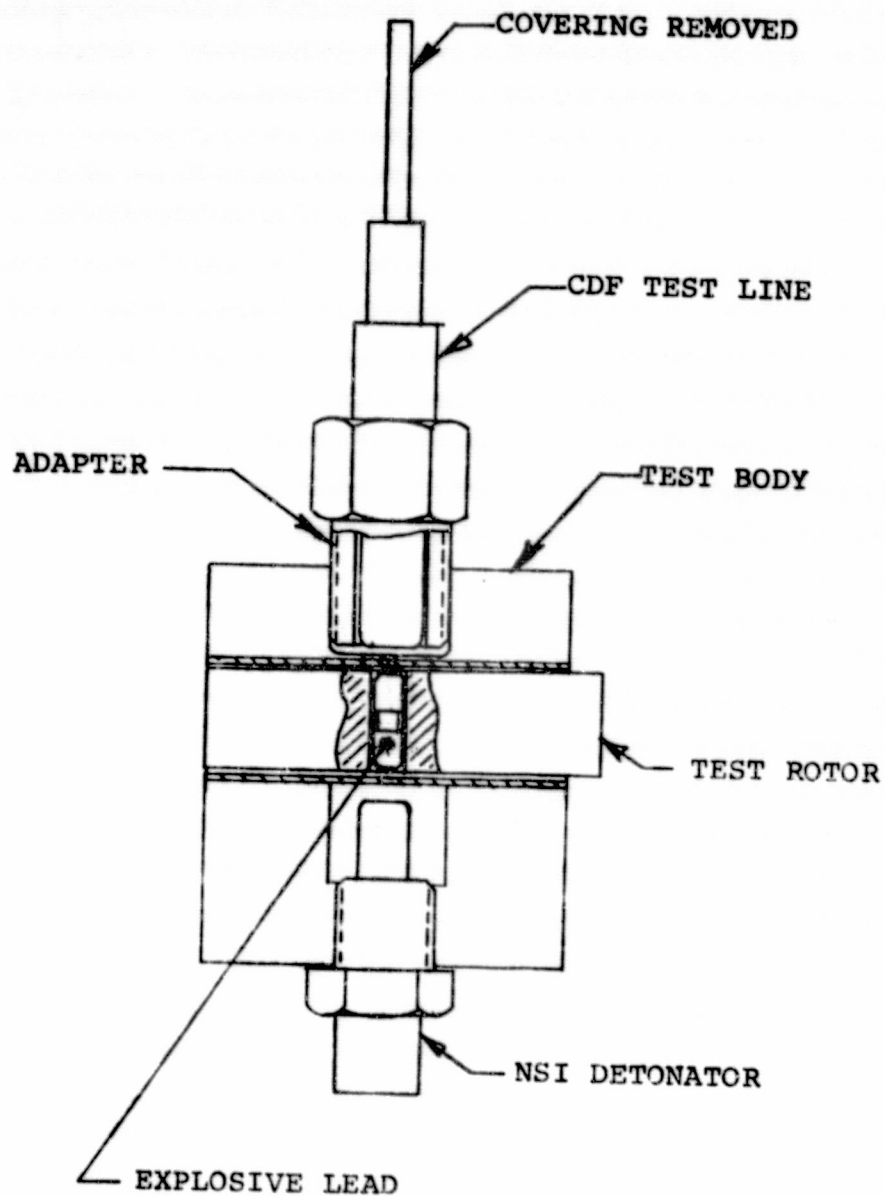
7.1.3 Test Requirements

The leak rate shall not exceed 1×10^{-6} cc/sec. air.

(A)

7.1.4 Test Procedure7.1.4.1 Calibration of Veeco Leak Detector

- a. The Veeco leak detector shall be calibrated by the veeco leak standard at the beginning of each production run and after each fifteen (15) minutes of operation. The calibration will be made in accordance with the operation and maintenance manual. The throttle valve should be wide open.
- b. All leak rate testing shall be performed by a certified operator.
- c. Place the items to be tested into a chamber and reduce the chamber pressure to less than 50 microns of mercury absolute and maintain this pressure for a minimum of fifteen (15) minutes.
- d. Close off the vacuum system and pressurize the chamber with dry helium gas to a pressure of 15 to 20 psig for a minimum of fifteen (15) minutes.



(A)

EXPLOSIVE LEAD TEST

FIGURE 5

7.1.4.1

Calibration of Veeco Leak DetectorATP 816780
(Continued)

- e. Reduce the chamber helium pressure to ambient. Remove items to be tested.
NOTE: Remove only the quantity of items that can be processed in a fifteen (15) minute period.
- f. After the quantity of items (to be processed in a fifteen [15] minute period) have been removed, repressurize the remaining items with 15 to 20 psig of dry helium gas.
NOTE: Items not processed with the maximum time limit (fifteen [15] minutes) will be reprocessed starting with paragraph c.
- g. Air wash the items with a stream of compressed air or dry nitrogen.
- h. Place item(s) in the appropriate test fixture and energize leak detector start switch.
- i. After test valve opens as indicated by the test light, observe meter reading.
- j. Convert meter reading to leak rate using the following formula:
$$\text{Leak Rate} = \frac{(\text{SENSITIVITY CALIBRATOR LEAK RATE}) \times (\text{METER READING})}{\text{METER READING OBTAINED WITH SENSITIVITY CALIBRATOR}}$$

or by using the conversion table supplied with the sensitivity calibrator used.
- k. Determine if part meets specification requirement. Mark discrepant parts immediately with Green Plastic Tape.
- l. Repeat steps for each unit to be tested.
- m. Subject the test specimen to N-ray inspection per paragraph 5.3.

(B)

7.1.5

Evaluation of Test

- a. The 1×10^{-6} cc/sec air shall not be exceeded.

7.2 EXPLOSIVE LEAD AMBIENT FIRING TEST

7.2.1 Reference

Table II of this procedure.

7.2.2 Test Quantity

Sample per paragraph 3.2 of this procedure.

7.2.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>
NSI Detonator	-----	ME453-0021-007 or CFM ME453-0021-009
CDF Line	-----	10A00455 or equiv. CFM

7.2.4 Requirement

Explosive lead assembly test samples shall transfer high order detonation from the NSI Detonator to the CDF test lead when fired using the test setup of Figure 5.

7.2.5 Procedure

- a. Install explosive lead into the test fixture per Figure 5.
- b. Install NSI Detonator and torque to 115-120 inch-pounds.
- c. Initiate the NSI Detonator using the NASA Standard Firing Unit or a 5.0 ampere D.C. current applied to the detonator firing circuit.

7.2.6 Evaluation

The explosive lead shall have fired and caused high order detonation of the CDF test lead as evidenced by total consumption of the explosive core and metal shield.

ATP 816780

APPENDIX A
TEST DATA SHEETS

TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
OPERATIONAL (90° ROTATION)

REPORT NUMBER _____

DATE _____

JOB NUMBER _____

W. O. NUMBER _____

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV.

CUSTOMER SPECIFICATION NASA 10A00465

TMC/S PROCEDURE ATP 816780 REV. ____

TEST EQUIPMENT ITEM NUMBERS

REQUIREMENTS ELAPSED TIME FOR 90 DEGREE ROTATION SHALL NOT EXCEED 250 MILLISECONDS.

UNIT NO. _____

SERIAL NO. _____

TEST TEMP. _____

[illegible]

TECHNICIAN

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

II. ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS

DISCREPANCY/S NOTED OF UNIT/S.



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

TEST DATA SHEET
FOR
CIRCUITRY CHECKS

REPORT NUMBER _____

DATE _____

JOB NUMBER _____

W.O. NUMBER _____

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. _____

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S PROCEDURE ATP 816780 REV. _____

REQUIREMENTS: SAFE POSITION

ARMED POSITION

A) G-H, K-N, P-R & S-T PIN TO PIN VOLTAGE
SHALL BE LESS THAN 750 MILLIVOLTS @
2.5 AMPERES

A) J-H, K-L, R-N, & T-U PIN TO PIN VOLTAGE
SHALL BE LESS THAN 750 MILLIVOLTS @ 2.5
AMPERES.

B) J-H, K-L, R-N & T-U PIN TO PIN SHOULD
INDICATE AN OPEN CIRCUIT.

B) G-H, K-N, P-R & S-T PIN TO PIN SHOULD
INDICATE AN OPEN CIRCUIT.

C) SOLENOID RESISTANCE SHALL BE 10.52-
11.72 ohms

UNIT S/N	①	RECORD VOLTAGE READING OR WRITE OPEN IN EACH COLUMN BELOW										SOLENOID OHMS
		G-H	K-N	P-R	S-T	J-H	K-L	R-N	T-U	F-M	V-CASE	
	S											X
	A											X
	S											X
	A											X
	S											X
	A											X
	S											X
	A											X
	S											X
	A											X
	S											X
	A											X
	S											X
	A											X

① UNIT POSITION S = SAFE A = ARM

TECHNICIAN _____

WITNESS _____

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☐ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S _____

DID NO. _____
CDRL NO. _____
P.O. NO. _____
CONTRACT NO. _____

DATA MGR. FILE NO. QTP 816780
DEPT FILE NO. _____
ISSUE DATE 19 November 1977
REVISION A
SUPERSEDING N/C
DATE 12 September 1977

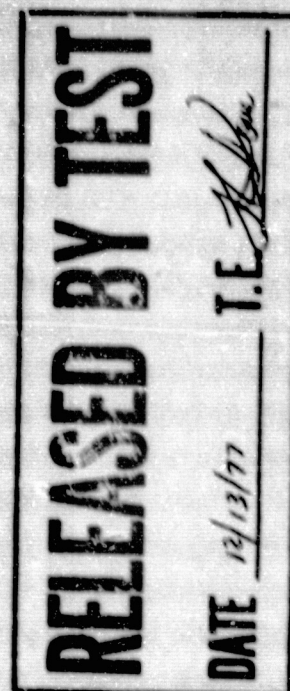
QUALIFICATION TEST PROCEDURE
FOR
SAFETY AND ARMING DEVICE (S&A)
TMc/S PN 816780

PREPARED FOR
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GEORGE C. MARSHALL SPACE FLIGHT CENTER
MARSHALL SPACE FLIGHT CENTER, ALABAMA

CONTRACT NAS 8-31973

Teledyne McCormick Selph

3601 UNION ROAD, HOLLISTER, CALIFORNIA 95023



PREPARED BY	TELEDYNE McCORMICK SELPH PROCEDURE AMENDMENT	NUMBER AND REVISION LETTER
<i>Harry Koue</i> H. Koue		QTP 816780 REV. A
APPROVALS		TYPE
<i>Frank Mortela</i> F. Mortela - Project Engr.		QUALIFICATION TEST PROCEDURE
<i>M. Creech 3/7/78</i> M. Creech - Quality Engr.		DATE
<i>H. A. Dixon 3/7/78</i> K. Dixon - Reliability Engr.		3 MARCH 1978
TITLE		AMENDMENT NUMBER
		I
		PAGE 1 OF 2

QUALIFICATION TEST PROCEDURE FOR SAFETY AND ARMING DEVICE (S&A) TMc/S P/N 816780

PER NASA/MSFC HUNTSVILLE, ALABAMA TWX MESSAGE 9105900455/042 DATED 6 MARCH 1978

PAGE 12 CHANGE:

TABLE II
SINUSOIDAL VIBRATION

<u>RATE</u>	<u>FREQUENCY (Hz)</u>	<u>LEVEL</u>
THREE (3) OCTAVES PER MINUTE	3.0 - 8.5 8.5 - 35.0 35.0 - 50.0	0.80 IN. DIA. 3.0 g's PEAK 1.0 g PEAK

TO:

TABLE II
SINUSOIDAL VIBRATION

<u>RATE</u>	<u>FREQUENCY (Hz)</u>	<u>LEVEL</u>
THREE (3) OCTAVES PER MINUTE	5 - 10 10 - 40	1.0 g PEAK 1.7 g PEAK

TELEDYNE McCORMICK SELPH

PROCEDURE AMENDMENT

(CONTINUATION SHEET)

NUMBER AND REVISION LETTER	AMENDMENT NUMBER	DATE	PAGE
QTP 816780 REV. A	I	3 MARCH 1978	2 OF 2

TITLE:

QUALIFICATION TEST PROCEDURE FOR SAFETY AND ARMING DEVICE (S&A) TMc/S P/N 816780

Pg. 12-18

Paragraphs 5.3, 5.4 and 5.5 ADD:

"Install two CDF Assemblies (ME901-0052-0007) and two NSI Detonators (ME 953-0021-0007 or 0009) on each S&A Device prior to dynamic testing in qualification to provide a more exact mass simulation for the S&A. The CDF assembly is to be trimmed flush with the backshell of the end fitting. Both the detonator and CDF ends are to be torqued to 150 ± 10 inch-lbs."

Pg. 32

Paragraph 5.10 ADD:

"The PIC Ground Ordnance Firing Assembly 17A10436 shall be used to fire all Qualification Safety and Arming Device Detonators. This will include making a checkout box and associated cables for the 17A10436 assembly."

Pg. 32

Paragraph 5.10.3

CHANGE: Firing unit Model C72-0833

TO: Firing unit Model 17A10436

QTP 816780
Revision A

APPROVAL SHEET

Harry Koue 10/28/77
Prepared by H. Koue
Test Engineer

H. Ghilarducci 11/14/77
Manager, Test
H. Ghilarducci

R. E. McDonald
Quality Engineer
R. McDonald

Frank Mortela 10/28/77
Project Engineer
F. Mortela

C. Campbell 11/15/77
Program Manager
C. Campbell

K. Dixon 11/15/77
Manager, Reliability
K. Dixon

Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama
35812

ORIGINAL PAGE IS
OF POOR QUALITY

DEC 5 1977

Reply to Attn of EP14(77-313)

Teledyne McCormick Selph
Attn: Mr. R. S. Akin
3601 Union Road
P. O. Box 6
Hollister, California 95023



Subject: Contract NAS8-31973

The S&A qualification test procedure, QTP 816780, revision A, and the acceptance test procedure, ATP 816780, revision B, have been reviewed and found acceptable providing a vibration duration is added to table V of ATP 816780.

Richard L. Beck

Richard L. Beck
Contracting Officer's Representative

INDEX OF ACTIVE SHEETS

PAGE NUMBER	REV. LTR.	PAGE NUMBER	REV. LTR.	PAGE NUMBER	REV. LTR.	PAGE NUMBER	REV. LTR.
Title Page	A	19		41			
i	A	20	A	42	A		
ii		21					
iii		22					
1		23					
2	A	24					
3		25					
4	A	26					
5		27					
6	A	28					
7	A	29					
8		30					
9		31					
10		32					
11		33					
12		34					
13	A	35					
14		36					
15	A	37					
16	A	38					
17	A	39					
18		40					

TABLE OF CONTENTS

<u>PARAGRAPH</u>	<u>TITLE</u>	<u>PAGE</u>
1.0	SCOPE.	1
2.0	APPLICABLE DOCUMENTS	1
3.0	TEST REQUIREMENTS.	3
3.1	NONDESTRUCT TESTS.	3
3.2	ENVIRONMENTAL AND FUNCTION TESTS	3
4.0	QUALITY ASSURANCE PROVISIONS	5
4.1	TEST DIVISION.	5
4.2	TEST RESPONSIBILITY.	5
4.3	TEST CONDITIONS.	5
4.4	TEST EQUIPMENT	5
4.5	ACCURACY OF TEST EQUIPMENT	6
4.6	SAFETY	6
4.7	TEST REPORTING	6
4.8	TEST DATA.	6
4.9	TOLERANCE.	7
4.10	UNIT MALFUNCTION	7
5.0	QUALIFICATION ENVIRONMENTAL AND FUNCTION TESTS .	8
5.1	THERMAL SHOCK.	8
5.2	SALT FOG TEST.	10
5.3	SINUSOIDAL VIBRATION	12
5.4	RANDOM VIBRATION	14
5.5	SHOCK.	18
5.6	TEMPERATURE HUMIDITY	21
5.7	LEAK (BUBBLE TYPE) TEST.	23
5.8	AMBIENT TEMPERATURE ELECTRICAL CHECK-OUT	25
5.9	TEMPERATURE ELECTRICAL CYCLE	30
5.10	FUNCTION TESTS	32

TABLE OF CONTENTS
(Continued)

<u>TABLES</u>	<u>TITLE</u>	<u>PAGE</u>
I	QUALIFICATION TEST SEQUENCE.	4
II	SINUSOIDAL VIBRATION	12
III	LIFT-OFF, BOOST AND REENTRY RANDOM VIBRATION . .	15
IV	RANDOM VIBRATION TIME SCHEDULE	16
V	SHOCK LEVEL CRITERIA	20
VI	SHOCK IMPACT SCHEDULE.	20

<u>FIGURES</u>		
1	VIBRATION AND SHOCK TEST SETUP	34
2	OPERATIONAL AND ELECTRICAL TEST SETUP.	35
3	TYPICAL OSCILLOGRAPH TRACES.	36
4	FUNCTION TEST SETUP.	37
4a	FUNCTION (SAFE) TEST SET-UP.	38
5	TEST DATA SHEET FOR OPERATIONAL (90° ROTATION) .	39
6	TEST DATA SHEET FOR CIRCUITRY CHECKS	40
7	TEST DATA SHEET FOR INSULATION RESISTANCE. . . .	41
8	TEST DATA SHEET FOR CONTINUITY TEST.	42

QUALIFICATION TEST PROCEDURE

1.0 SCOPE

This document defines the tests, test conditions and test procedures for qualification testing of a Safety and Arming Device (S&A) TMC/S PN 816760 to demonstrate compliance to National Aeronautics and Space Administration/Marshall Space Flight Center (NASA/MSFC) Specification 10A00465.

2.0 APPLICABLE DOCUMENTS

2.1 PRECEDENCE OF DOCUMENTS

In the event of conflict between the requirements of this document and the specifications referenced herein, this document shall take precedence.

2.2 DOCUMENTS

The following documents of the issue and date indicated form a part of this procedure to the extent specified herein. Documents not identified herein by a revision date, letter or amendment shall be of the issue in effect by contract on date of this procedure approval.

SPECIFICATIONS

MIL-Q-9858
16 December 1963

Requirements, Quality Program

MIL-C-45662
9 February 1962

Requirements, Calibration System

STANDARDS

MIL-STD-453(1) 4 September 1963	Inspection, Radiographic
MIL-STD-831 28 August 1963	Test Reports, Preparation of
MIL-STD-810C 10 March 1975	Environmental Test Methods

OTHER PUBLICATIONSRockwell International Documents

MT0501-505 25 July 1975	Neutron Radiographic Inspection of Apollo Ordnance
----------------------------	---

TMc/S Drawings

816780	Safety and Arming Device
--------	--------------------------

NASA/MSFC

10A00465, Rev. C 19 July 1977	Safety and Arming Device Range Safety System Space Shuttle Solid Rocket Booster, Specification for	(A)
----------------------------------	--	-----

NHB 5300.4 (1C) July 1971	Reliability and Quality Assurance Publication
------------------------------	--

3.0

TEST REQUIREMENTS

QTP 816780

3.1

NONDESTRUCT TESTS

All Nondestruct Tests, Examination of Product and Radiographic Inspection, specified in Table I of TMC/S Acceptance Test Procedure ATP 816780, shall be performed on one-hundred percent (100%) of all the qualification test units prior to start of the qualification tests specified herein.

3.2

ENVIRONMENTAL AND FUNCTION TESTS

All qualification test units that have passed the Nondestruct Tests shall be subjected to the Environmental and Functional Tests specified in Table I.

TABLE I
QUALIFICATION TEST SEQUENCE

TEST	QTP 816760 PARA.	NASA 10A00465 PARA.	SPECIMEN					
			1-3	4-5	6-8	9-10	11-12	13-14
Acceptance (Nondestructive)	△	4.4.2	1	1	1	1	1	1
Thermal Shock	5.1	4.3.3	2	2	2	2	-	-
Salt Fog	5.2	4.3.4	3	3	3	3	-	-
Sinusoidal Vibration △	5.3	4.3.6	4	4	4	4	2	2
Random Vibration △	5.4	4.3.6						
a. Mission 1 △			4	4	4	4	2	2
b. Mission 2-6 △			-	-	-	-	3	3
c. Mission 7-10 △			-	-	-	-	-	4
Shock	5.5	4.3.9						
a. Mission 1 △			-	-	-	5	4	5
b. Mission 2-6 (5 times listed duration) △			-	-	-	-	5	6
c. Mission 7-10 (4 times listed duration) △			-	-	-	-	-	7
Temperature-Humidity	5.6	4.3.8	5	5	5	6	6	8 (A)
Leak Test	5.7	4.3.7	6	6	6	7	7	9
Electrical Checkout	5.8	4.3.10	7	7	7	8	8	10
Temperature Electrical Cycle	5.9	4.3.11	8	8	8	9	9	11
Low Temp. Function Armed	5.10	4.3.12	9	-	-	-	-	12
Low Temp Function Safe	5.10	4.3.13	-	9	-	-	-	-
High Temp Function Armed	5.10	4.3.14	-	-	9	-	10	-
High Temp Function Safe	5.10	4.3.15	-	-	-	10	-	-

- 1 All specimens shall have passed the nondestructive portion of the acceptance test, and data from the acceptance test shall be submitted as part of the qualification test.
- 2 Perform electrical checkout in accordance with paragraph 5.8 following this test environment.
- 3 Sequence of sinusoidal and random vibration optional.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 TEST DIVISION

The Test Division is under the jurisdiction of the Quality Assurance Department which is directly responsible for the high standards required by TMc/S Quality Assurance Manual. All test instructions not referenced in this procedure are contained in TMc/S Quality Manual which reflects the requirements of MIL-Q-9858.

4.2 TEST RESPONSIBILITY

Unless deviations are authorized by the customer, testing will be accomplished by TMc/S in accordance with this procedure.

- a. TMc/S will use their facilities or other laboratories acceptable to the customer.
- b. Witnessing of the testing is at the discretion of NASA and/or Government Source Inspector.
- c. The customer representative shall be notified at least two (2) days in advance of start of qualification testing.

4.3 TEST CONDITIONS

Unless specified otherwise, all tests shall be performed at an atmospheric pressure of between 28 and 32 inches of mercury (711.2 - 812.8mm Hg), a temperature of between +60°F and +90°F (16° - 32°C), and a relative humidity of not more than 90%.

4.4 TEST EQUIPMENT

Except when substitutions become absolutely necessary, the described test equipment shall be used. If equipment substitutions are necessary, equipment of equal or superior accuracy shall be used, as approved by the Test Supervisor.

4.5 ACCURACY OF TEST EQUIPMENT

The accuracy of instruments and facility type test equipment used to control and monitor test parameters shall be calibrated periodically. The accuracy of special test equipment systems used to control and monitor test parameters shall be calibrated periodically and the period for calibration shall be less than the calibration period of the instruments contained within the special equipment system.

- a. Calibration for all measuring and test equipment shall be in accordance with TMc/S Quality Assurance Manual and MIL-C-45662.

4.6 SAFETY

TMc/S safety practices shall be followed. All test equipment and personnel shall be adequately protected and barricaded.

4.7 TEST REPORTING

A test report conforming to MIL-STD-831, shall be submitted within thirty (30) days after completion of testing at TMc/S showing the results of each test. This report shall show evidence of satisfactory completion of all testing performed on the units. Photographs of a typical shock, sinusoidal vibration, random vibration function test set up and photographs of all fired devices shall be included in the report. Random vibration dynamic test input charts shall also be in the report. The minimum film size shall be four (4) inches wide and five (5) inches long with a 3/16-inch clear border. A negative of each photograph shall accompany the report.

(A)

4.8 TEST DATA

All data, charts and reports generated as objective evidence of product conformance to the applicable requirements shall be retained by TMc/S.

4.9 TOLERANCE

Unless otherwise specified, the maximum allowable tolerances shall be as follows:

Temperature	$\pm 5^{\circ}\text{F}$ ($\pm 3^{\circ}\text{C}$)
Vibration Amplitude	$\pm 10\%$
Vibration Frequency	$\pm 2\%$ or $1/2$ Hz below 20 Hz
Vibration Duration	$+ 10\%$ -0%
Vibration Composite RMS	$\pm 10\%$

(A)
|

4.10 UNIT MALFUNCTION

4.10.1 Nondestructive Tests

A unit which does not meet the requirements of the nondestructive tests shall be rejected on an individual basis; however, the unit may be reworked, if possible, and retested. If the unit passes the retest, it may be re-instated in the lot.

4.10.2 Environmental/Performance Tests

Testing shall stop when a failure occurs and TMc/S Test Department shall notify TMc/S Reliability Department immediately. NASA/MSFC shall be notified within twenty-four (24) hours and full particulars concerning the failure shall be documented in accordance with TMc/S standard practices together with action taken to correct the defect found. This report shall be submitted to NASA/MSFC for evaluation and NASA/MSFC approval shall be received before tests are repeated.

5.0

QTP 816780

QUALIFICATION ENVIRONMENTAL AND FUNCTION TESTS

5.1

THERMAL SHOCK

5.1.1

Reference

- a. NASA Specification 10A00465, paragraph 4.3.3.
- b. MIL-STD-810, Method 503.1, Procedure I.

5.1.2

Number of Units

Ten (10) each - Units 1-10 (see Table I).

5.1.3

Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib. Interval</u>
Temperature Chamber Messimers		TF4/8	N/A	N/A
Temperature Chamber Messimers		TF4/8	N/A	N/A
Temperature Recorder	Honeywell	31F1	$\pm 2^{\circ}\text{F}$	3 Months

5.1.4

Test Requirements

Each unit shall be subjected to the thermal shock test of MIL-STD-810, Method 509, Procedure I.

5.1.5

Test ProcedureSTEP

1. Place the test specimens into the conditioning chamber with a laboratory ambient temperature.
2. Raise the internal chamber temperature to plus $160 \pm 2.5^{\circ}\text{F}$ and maintain the temperature for a period of not less than four hours or until the test item stabilizes.
3. Transfer the units, at the conclusion of this time period and within five minutes, to a cold chamber with an internal temperature of minus $70 \pm 2.5^{\circ}\text{F}$.

5.1.5

Test Procedure (Continued)

QTP 816780

STEP

4. Expose the units to minus $70 \pm 2.5^{\circ}\text{F}$ for a period of not less than four (4) hours or until the test item stabilizes.
5. Transfer the units, at the conclusion of this time period and within five (5) minutes, back to the hot chamber maintained at plus $160 \pm 2.5^{\circ}\text{F}$.
6. Expose the units to plus $160 \pm 2.5^{\circ}\text{F}$ for a period of not less than four (4) hours or until the test item stabilizes.
7. Repeat Steps 2 through 6.
8. Repeat Steps 2 through 6.
9. Return the test items to laboratory ambient conditions.

5.1.6

Evaluation

- a. No visible damage shall be apparent.
- b. See Table I for further tests.

5.2 SALT FOG TEST

5.2.1 Reference

- a. NASA Specification 10A00465, Paragraph 4.3.4.
- b. MIL-STD-810, Method 509.1.

5.2.2 Number of Units

Ten (10) each, Units 1-10 (see Table I).

5.2.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib. Interval</u>
Salt Fog Chamber	Bemco	BM	N/A	N/A
Temperature Recorder	Honeywell	31F1	$\pm 2^{\circ}\text{F}$	3 Months

5.2.4 Test Requirements

Each unit shall be subjected to the Salt Fog Test of MIL-STD-810, Method 509.1, Procedure I for forty-eight (48) hours. Following the exposure each unit shall be rinsed in tap water and visually examined. Forty-eight (48) hours later the unit shall again be examined for corrosion.

5.2.5 Test Procedure

NOTE 1: If the salt fog chamber has not been in continuous use prior to the start of this test, a twenty-four (24) hour test run shall be accomplished followed by measurements of the sodium chloride content and pH.

NOTE 2: If the salt fog chamber has been in continuous use measurement shall be made at completion of the test.

5.2.5 Test Procedure (Continued)

- a. Prepare a 5 ± 1 percent by weight salt solution.
 - b. Required parameters for the salt solution are:
 - (1) A salt solution specific gravity of 1.020 to 1.041.
 - (2) A salt solution pH of 6.5 to 7.2.
 - (3) A total collection of 0.5 ML to 3.0 ML of solution per hour for each 80 square centimeters of collecting area.
 - c. Maintain a chamber temperature of $95^{\circ}\text{F} \pm 2.5^{\circ}\text{F}$ for the entire test duration of forty-eight (48) hours.
 - d. The air at the point of release from the nozzle should have a relative humidity of 85 percent.
 - e. Expose the test unit to the salt fog environment for a period of forty-eight (48) hours.
 - f. At the end of the forty-eight (48) hour exposure remove the units from the salt fog chamber.
 - g. Visually examine the unit(s) for any damage or deterioration resulting from the test.
- NOTE: To aid in examination, a gentle wash in running water not warmer than 100°F may be used.
- h. The unit shall be stored in an ambient atmosphere for forty-eight (48) hours minimum for drying.
 - i. Make the appropriate observation entries for the units on the Salt Fog Test Data Sheet.

5.2.6 Evaluation

- a. No visible damage shall be apparent.
- b. See Table I for further qualification test requirements.

5.3.1

Reference

- a. NASA Specification 10A00465, paragraph 4.3.6.

5.3.2

Units to be Tested

Fourteen (14) each, Units 1-14 (see Table I).

5.3.3

Test Equipment

A list of the test equipment used will be in the test report provided by the outside test laboratory conducting the vibration test.

5.3.4

Test Requirements

Each unit shall be mounted onto the vibration table as shown in Figure 1. Subject each unit to the vibration levels and duration shown in Table II. The specified levels shall be applied at laboratory ambient condition with the unit in the ARMED position. One sweep shall be performed in all three mutually perpendicular axes of the unit. The sweep rate shall be 3.0 octaves per minute. The switch position shall be monitored during the test. After each axis of vibration, the unit shall be rotated from ARM to SAFE to ARM. The elapsed time for each 90 degrees rotation shall not exceed 250 milliseconds.

TABLE II
SINUSOIDAL VIBRATION

<u>Rate</u>	<u>Frequency (Hz)</u>	<u>Level</u>
Three (3)	3.0 - 8.5	0.80 in. d.a.
Octaves per	8.5 - 35.0	3.0 g's peak
Minute	35.0 - 50.0	1.0 g peak

NOTE: Test tolerances per MIL-STD-810.

5.3.5 Test Procedure

5.3.5.1 Sinusoidal Vibration

- a. Attach the unit to the vibration fixture as shown in Figure 1 and record bolt torque value. Connect the monitor switch position indicator module to the electrical connector of the device.
- b. Attach a control accelerometer to the vibration fixture and a monitor accelerometer to each test specimen as shown in Figure 1. All accelerometer outputs shall be recorded (A) on an oscillograph or X-Y plotter.
- c. Test conditions are laboratory ambient.
- d. Take a typical photograph (axis optional) of the test set-up.
- e. Place the device in the ARMED position.
- f. Subject each unit to sinusoidal vibration at levels specified in Table II and in each of the three mutually perpendicular axes of the unit as shown in Figure 1 and observe the monitor switch position indicator during the test.
- g. Cycle the unit from ARM to SAFE to ARM after completion of each axis of vibration. Cycling shall be performed per paragraph 5.8.5.1 of this procedure except that only the 28 volt test shall be performed.
- h. Record number of cycles and elapsed time for each 90 degree rotation.
- i. Monitor the S&A switches during vibration for indication of rotor rotation greater than 7.5°.

5.3.6 Evaluation

- a. No visible damage shall be observed.
- b. There shall be no rotor rotation greater than 7.5° as indicated by the monitor switch position indicator.
- c. The elapsed time for each 90 degree rotation shall not exceed 250 milliseconds, actuation current shall not exceed 3.0 amperes and the switches shall properly indicate rotor position.
- d. All units shall next be subjected to random vibration.

5.4 RANDOM VIBRATION

5.4.1 Reference

- a. NASA Specification 10A00465, paragraph 4.3.6.
- b. MIL-STD-810.

5.4.2 Units to be Tested

Fourteen (14) each - see Tables I and IV.

5.4.3 Test Equipment

A list of the test equipment used will be in the test report provided by the outside test laboratory conducting the Random Vibration Test.

5.4.4 Test Requirements

Each unit shall be vibrated to the levels specified in Table III for the duration shown in Table IV. The lift-off and boost random levels shall be applied with the unit in the ARMED position. The re-entry random vibration level shall be applied with the unit in the SAFE position. All testing shall be at laboratory ambient conditions. The switch position shall be monitored during the test. After each axis of vibration the device shall be cycled from SAFE to ARMED to SAFE. The elapsed time for 90° rotation shall not exceed 250 milliseconds and actuation current shall not exceed 3.0 amperes. All test tolerances shall be per MIL-STD-810 except the lower spectral density tolerance shall be minus 30 percent.

TABLE III
LIFT-OFF, BOOST AND REENTRY RANDOM VIBRATION

1. Lift-off Random Vibration Criteria (a) Test duration (see Table IV)

Y AXIS (ARMED POSITION)	X AND Z AXES (ARMED POSITION)
20 Hz @ 0.075 g ² /Hz	20 Hz @ 0.040 g ² /Hz
20 - 40 Hz @ +3 dB/Oct.	30 - 40 Hz @ +3 dB/Oct.
40 - 54 Hz @ 0.15 g ² /Hz	40 - 280 Hz @ 0.08 g ² /Hz
54 - 100 Hz @ +9 dB/Oct.	280 - 400 Hz @ +6 dB/Oct.
100 - 170 Hz @ 0.95 g ² /Hz	400 - 800 Hz @ 0.16 g ² /Hz
170 - 2000 Hz @ -3 dB/Oct.	800 - 2000 Hz @ -6 dB/Oct.
2000 Hz @ 0.082 g ² /Hz	2000 Hz @ 0.026 g ² /Hz
Composite - 22.2 grms	Composite - 13.2 grms

2. Boost Random Vibration Criteria (b) Test duration (see Table IV)

Y AXIS (ARMED POSITION)	X AND Z AXES (ARMED POSITION)
20 Hz @ 0.19 g ² /Hz	20 Hz @ 0.040 g ² /Hz
20 - 30 Hz @ +3 dB/Oct.	20 - 40 Hz @ +3 dB/Oct
30 - 53 Hz @ 0.28 g ² /Hz	40 - 135 Hz @ 0.080 g ² /Hz
53 - 100 Hz @ +6 dB/Oct.	135 - 250 Hz @ +3 dB/Oct.
100 - 170 Hz @ 1.0 g ² /Hz	250 - 440 Hz @ 0.15 g ² /Hz
170 - 2000 Hz @ -3 dB/Oct.	440 - 500 Hz @ +9 dB/Oct.
2000 Hz @ 0.09 g ² /Hz	500 - 1100 Hz @ 0.22 g ² /Hz
Composite = 22.9 grms	1100 - 2000 Hz @ -6 dB/Oct
	2000 Hz @ 0.067 g ² /Hz
	Composite = 17.4 grms

(A)

TABLE III
(Continued)

3. Reentry Random Vibration Criteria Test duration (see Table IV)

Y AXIS (SAFE POSITION)	X AND Z AXES (SAFE POSITION)
20 Hz @ 0.50 g^2 /Hz	20 - 40 Hz @ 0.75 g^2 /Hz
20 - 40 Hz @ +3 dB/Oct.	40 - 50 Hz @ -12 dB/Oct.
40 - 60 Hz @ 1.00 g^2 /Hz	60 - 400 Hz @ 0.13 g^2 /Hz
60 - 75 Hz @ -12 dB/Oct.	400 - 2000 Hz @ -3 dB/Oct.
75 - 230 Hz @ 0.36 g^2 /Hz	2000 Hz @ 0.026 g^2 /Hz
230 - 500 Hz @ -12 dB/Oct.	
500 - 1000 Hz @ 0.017 g^2 /Hz	
1000 - 2000 Hz @ -6 dB/Oct.	
2000 Hz @ 0.0042 g^2 /Hz	
Composite - 11.9 grms	Composite - 12.2 grms

TABLE IV
RANDOM VIBRATION TIME SCHEDULE

UNIT NO.	MISSION NO.	VIBRATION TIME DURATION (PER AXIS)		
		LIFT-OFF	BOOST	RE-ENTRY
1 thru 14	1	60 Seconds	120 Seconds	90 Seconds
11 thru 14	2 thru 6	50 Seconds	200 Seconds	150 Seconds (A)
13 and 14	7 thru 10	40 Seconds	160 Seconds	120 Seconds

5.4.5 Test Procedure

- a. Attach the unit to the vibration fixture as shown in Figure 1.
- b. Attach a control accelerometer to the vibration fixture and a monitor accelerometer to each test specimen as shown in Figure 1. All accelerometer outputs shall be recorded on an oscillograph or X-Y plotter. (A)
- c. Connect the monitor switch position indicator module to the electrical connector of the device.
- d. Test conditions are laboratory ambient.
- e. Perform an equilization run prior to the actual test.
- f. Vibration shall be applied along the three (3) mutually perpendicular axes of the unit as shown in Figure 1. Observe the monitor switch position indicator during all vibration tests.
- g. Place the unit in the ARMED Position and vibrate at the lift-off levels specified in Table III for the time duration specified in Table IV.
- h. Vibrate the unit at the boost levels specified in Table III for the time duration specified in Table IV.
- i. Place the unit in the SAFE position and vibrate at the reentry levels specified in Table III for the time duration specified in Table IV.
- j. Record all power spectral density levels.
- k. Cycle the unit from SAFE to ARM to SAFE after completion of each axis of vibration. Cycling shall be performed per paragraph 5.8.5.1 of this procedure except that only 28 volts cycling shall be performed.
- l. Record number of cycles and elapsed time for 90 degree rotation.

5.4.6 Evaluation

- a. No visible damage shall be observed.
- b. There shall be no rotor rotation greater than 7.5° as indicated by the monitor switch position indicator.
- c. The elapsed time for 90° rotation shall not exceed 250 milliseconds, the actuation current shall not exceed 3.0 amperes, and the switches properly indicate rotor position.
- d. Subject units to the remaining tests listed in Table I.

5.5 SHOCK

5.5.1 Reference

- a. NASA Specification 10A00465, paragraph 4.3.9.

5.5.2 Units to be Tested

Six (6) each - see Table I.

5.5.3 Test Equipment

A list of the test equipment used will be in the test report provided by the outside test laboratory conducting the shock tests.

5.5.4 Test Requirements

Each unit shall be mounted onto the shock fixture as shown in Figure 1. Subject the unit to the shock levels specified in Table V for the number of shock impacts specified in Table VI. Test conditions shall be laboratory ambient. The unit shall be in the SAFE Position. The switch position shall be monitored during the test. After each axis of shock the device shall be cycled from SAFE to ARMED to SAFE. The elapsed time for 90° rotation shall not exceed 250 milliseconds and the actuation current shall not exceed 3.0 amperes.

5.5.5 Test Procedure

- a. Attach the unit to the test fixture as shown in Figure 1 and place the unit in the SAFE position. Connect the monitor switch position indicator module to the electrical connector of the device.
- b. Test conditions are laboratory ambient.
- c. Subject each unit to the Ordnance, SRB Water Landing and SRB Parachute deployment shock levels shown in Table V.

5.5.5 Test Procedure (Continued)

- d. Units shall be subjected to the number of shock impacts specified in Table VI in the X, Y, and Z axis shown in Figure 1.
- e. Observe the monitor switch position indicator during the test.
- f. Cycle the unit from SAFE to ARM to SAFE after completion of each axis of shock. Cycling shall be performed per 5.8.5.1 of this procedure except that only 28 volts cycling shall be performed.
- g. Record number of cycles and elapsed time for 90 degree rotation.

5.5.6 Evaluation

- a. There shall be no rotor rotation greater than 7.5° as indicated by the monitor switch position indicator.
- b. There shall be no evidence of damage upon completion of all shock testing.
- c. The elapsed time for 90° rotation shall not exceed 250 milliseconds, actuation current shall not exceed 3.0 amperes, and the switches properly indicate rotor position.
- d. Subject both units to the leakage test (paragraph 5.4) upon completion of all shock testing and to the remaining tests listed in Table I.

TABLE V
SHOCK LEVEL CRITERIA

<u>Ordnance Shock</u>	
50 -	100 Hz at 12 dB/oct. 100 Hz at 94 G's peak
100 -	4,000 Hz at 6 dB/oct.
4,000 -	10,000 Hz at 1,875 G's peak

<u>SRB Water Landing</u>	
<u>Longitudinal Axis</u>	<u>Lateral Axes</u>
Half Sine Pulse	Half Sine Pulse
30 G's Peak Amplitude	20 G's Peak Amplitude
150 msec duration	100 msec duration

<u>SRB Parachute Deployment</u>	
<u>Longitudinal Axis</u>	<u>Lateral Axes</u>
Half Sine Pulse	Half Sine Pulse
6 G's Peak Amplitude	11 G's Peak Amplitude
300 msec duration	300 msec duration

TABLE VI
SHOCK IMPACT SCHEDULE

(For Ordnance Shock, SRB Water Landing and SRB Parachute Deployment)

UNIT NUMBER	MISSION NUMBER	NUMBER OF IMPACTS (PER AXIS)		
		X	Y	Z
9 thru 14	1	2	2	2
11 thru 14	2 thru 6	10	10	10
13 and 14	7 thru 10	8	8	8

(A)

5.6 TEMPERATURE HUMIDITY

5.6.1 References

- a. NASA Specification 10A00465, paragraph 4.3.8.
- b. MIL-STD-810B, Method 507, Procedure 1.

5.6.2 Units To Be Tested (See Table I)

Fourteen (14) each.

5.6.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib. Interval</u>
Humidity Chamber	Tenny	TH-27	+ 2°F	3 Months
Recorder	Bristols	43B	+ 2°F	3 Months
pH Tester Block Type Comparator	La Motte	6.00- 7.40	+ 0.1 pH unit	Annually

5.6.4 Test Requirements

Humidity test per MIL-STD-810, Method 507.1, Procedure I, is applicable except that the unit will be non-operating. There shall be no evidence of corrosion, peeling, chipping or blistering of the assembly finish.

5.6.5 Test Procedure

NOTE 1 - When unit is set up in the chamber, have a typical photograph taken.

NOTE 2 - Steam, or distilled, demineralized, or deionized water having a pH value between 6.0 and 7.2 at 73°F shall be used to obtain the specific humidity and this shall be verified prior to test start using a pH Tester Block Type Comparator.

5.6.5 Test Procedure (Continued)

- a. Place samples with sealing plugs installed in a temperature chamber which has been preconditioned between 59°F and 91°F with uncontrolled humidity.
- b. Raise temperature chamber to 160°F and humidity to 95% over a period of two (2) hours.
- c. The samples shall be maintained at 160°F, 95% humidity for not less than six (6) hours.
- d. With humidity maintained at 85% or greater, gradually reduce temperature to 82°F over a period of not less than 16 hours. This constitutes one (1) cycle.
- e. The number of continuous cycles shall be ten (10) for a total test time of not less than 240 hours.
- f. Upon completion of humidity cycling the samples may be wiped dry.

5.6.6 Evaluation

- a. There shall be no evidence of corrosion, peeling, chipping or blistering of the assembly.
- b. Subject the units to the remaining tests listed in Table I.

5.7 LEAK (BUBBLE TYPE) TEST

5.7.1 Reference

- a. NASA Specification 10A00465, paragraph 4.3.7.

5.7.2 Units To Be Tested

Fourteen (14) each - see Table 1.

5.7.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib. Interval</u>
Pressure Chamber	TMc/S	N/A	N/A	N/A
Vacuum Gauge	Matheson	30	± 0.5 in. Hg	3 Months
Vacuum Pump	Cenco	Megavac	N/A	N/A

5.7.4 Test Requirement

The test specimen shall have no leakage for two minutes at one (1) psia pressure (61,000 ft. altitude). Leakage is indicated by a steady stream of bubbles or a recurring succession of small bubbles from the unit.

5.7.5 Procedure

- a. Fill the transparent pressure vessel with distilled water so that when the vessel is in the "test" position, the unit(s) will be immersed at least one (1) inch, but not more than five (5) inches below the water.
- b. Attach the unit(s) to the elevated platform of the pressure vessel with the vacuum chamber rotated in the "no-test" position (unit(s) above water level).
- c. Seal the vacuum chamber and reduce the air pressure above the water to 0.5 inch of mercury (in. Hg) for at least two (2) minutes to boil off trapped air in the water then vent the chamber back to atmospheric condition.

5.7.5 Procedure (Continued)

- d. Re-seal the vacuum chamber and rotate it to the test position. (A)
- e. Reduce the pressure of the air space above the liquid to two (2) in. Hg absolute, and hold constant during the observation period of two (2) minutes.
NOTE: A steady stream or recurring succession of small bubbles from the unit indicates leakage.
- f. Rotate the chamber to the "no-test" position and then allow the air pressure above the liquid to return to laboratory atmospheric.
- g. Remove the unit(s) from the vessel and remove its surface liquid by blowing, blotting or air drying.

5.7.6 Acceptance Criteria

There shall be no leakage as evidenced by a continuous stream of bubbles being emitted from the test specimen.

NOTE: Bubbles which are the result of entrapped air on the exterior parts of the case shall not be considered as leaks.

5.8 AMBIENT TEMPERATURE ELECTRICAL CHECK-OUT

5.8.1 Reference

- a. NASA Specification 10A00465, paragraph 4.3.10.

5.8.2 Units To Be Tested

Fourteen (14) each - see Table I.

5.8.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib. Interval</u>
Megohmmeter	Freed	1620	$\pm 5\%$	3 Months
D.C. Power Supply	Perkins	TVCR-040-5	N/A	N/A
Function Monitor	Douglas	SA 1077-1	N/A	N/A
Cable	Douglas	SA 1077-3	N/A	N/A
Oscillograph	Honeywell	906	N/A	N/A
Resistance Circuit Tester	Alinco	101-5AF	$\pm 1\%$ RDG.	3 Months

5.8.4 Test Requirement

Perform all electrical check-outs at standard laboratory ambient test conditions. Cycle the S&A device from SAFE to ARMED to SAFE four (4) times each at voltage inputs of 24 Vdc, 28 Vdc, and 32 Vdc. The current required to actuate the solenoid or motor shall be monitored and recorded with each application of power and shall not exceed 3.0 amperes. Elapsed time for 90° rotation shall not exceed 250 milliseconds.

Ninety (90) Degree Rotation Test

- NOTES: A. Conduct all tests with the S&A unit at laboratory ambient conditions.
- B. The S&A unit shall be in the SAFE position when received. Upon completion of all check-out tests, the unit shall be returned to the SAFE position.
- C. The voltage applied to the S&A unit shall not exceed 32 vdc.

STEP:

1. Make all electrical connections per Figure 2.
2. Turn DC Power Supply ON, function monitor power switch ON and function monitor contact selector switch to OFF.
3. Hold the function monitor LOAD switch in the LOW TEMP position and adjust the power supply voltage until three (3) amperes D.C. is indicated on the function monitor current meter.
4. Adjust the CURRENT input of the oscillograph galvanometer for a deflection of fifteen (15) lines or other suitable deflection to measure 3 amperes.
5. Adjust the VOLTAGE, SAFE and ARMED inputs of the oscillograph galvanometer for deflections as in Figure 3.
6. Set oscillograph recorder PAPER SPEED to 10.0 inches per second.
7. Turn the oscillograph recorder TIMER switch ON.
8. Hold the function monitor LOAD switch in the AMBIENT position and adjust the power supply until 32 volts D.C. is indicated on the function monitor voltmeter.
9. Cycle the S&A unit from SAFE to ARM to SAFE four (4) times with the ACTUATE switch while running the oscillograph recorder.
10. Hold the function monitor LOAD switch in the AMBIENT position and adjust the power supply until 28 volts D.C. is indicated on the function monitor voltmeter.

5.8.5.1 Ninety (90) Degree Rotation Test QTP 816780
(Continued)

11. Cycle the S&A unit from SAFE to ARM to SAFE four (4) times with the ACTUATE switch running the oscillograph recorder.
12. Hold the function monitor load switch in the AMBIENT position and adjust the power supply until 24 volts D.C. is indicated on the function monitor voltmeter.
13. Cycle the S&A unit from SAFE to ARM to SAFE four (4) times with the ACTUATE switch while running the oscillograph recorder.
14. Verify that the actuation time from SAFE to ARM or from ARM to SAFE does not exceed 250 milliseconds and actuation current does not exceed 3 amperes.
15. Record all the test results on the Operational (90° Rotation) test data sheet.

5.8.5.2 Circuitry Check Tests

5.8.5.2.1 Calibration

STEP:

1. Place the function monitor contact selector to TARE VOLTAGE with the S&A unit in the SAFE position.
2. Verify the CONTACT TEST light is "ON" and adjust the power supply for 2.5 ± 0.05 amperes on the CURRENT meter.
3. Press the CONTACT TEST switch and read and record the voltage drop on the contact voltage drop meter. This is the TARE voltage.

NOTE: On the following contact voltage drop tests, the TARE voltage should be subtracted from the meter reading to obtain the actual (net) voltage drop. Net voltage drop shall not exceed 750 millivolts.

5.8.5.2.2 Contact TestSTEP:

1. Place the CONTACT SELECTOR in the G-H, K-N, P-R, S-T, F-M, and V-CASE positions.
2. Press the CONTACT TEST button and read the voltage on the CONTACT VOLTAGE DROP meter and record test results on test data sheet (Figure 6).

NOTE: The net voltage to be recorded is the meter reading less the TARE voltage.

3. Place the CONTACT SELECTOR to J-H, K-L, R-N, and T-U positions. In each position the CONTACT TEST light should remain "OFF" indicating an open circuit.
4. Place the CONTACT SELECTOR switch to "OFF".
5. Actuate the unit to the ARMED position.
6. Place the CONTACT SELECTOR in the J-H, K-L, R-N, and T-U positions.
7. Press the CONTACT TEST button and read the voltage on the CONTACT VOLTAGE DROP meter and record test results on test data sheet (Figure 5).
8. Place the CONTACT SELECTOR to G-H, K-N, P-R, and S-T positions. In each position the CONTACT TEST light should remain "OFF" indicating an open circuit.
9. Place the CONTACT SELECTOR TO "OFF".
10. Return the unit to SAFE position.
11. Reduce the power supply voltage to zero.

5.8.5.2.3 Solenoid Resistance TestSTEP:

1. Connect the Alinco resistance circuit tester to the function monitor, + to binding post N and - to binding post M.
2. Measure and record the solenoid resistance on test data sheet (Figure 6). The solenoid resistance shall be 10.52 to 11.72 ohms.

5.8.5.2.3 Circuitry Check Tests (Continued)

STEP:

3. Disconnect the circuit tester.

5.8.5.2.4 Insulation Resistance TestsSTEP:

1. Disconnect the power supply from the function monitor.
2. Adjust Megohmmeter's test voltage to 500 vdc.
3. Connect Megohmmeters negative lead to the CASE binding post on the function monitor.
4. Using the Megohmmeter positive lead check the insulation resistance between the following pins and the case: F, G, H, J, K, L, M, N, P, R, S, T and U.
5. Record insulation resistance on test data sheet (Figure 7).

5.8.5.2.5 Continuity TestSTEP:

1. Place the rotor in the SAFE position.
2. Using an volt ohmmeter verify that an open circuit exists between the following pins:
V-A V-D V-G V-K V-N V-S
V-B V-E V-H V-L V-P V-T
V-C V-F V-J V-M V-R V-U
3. Record continuity on test data sheet (Figure 8).

5.9 TEMPERATURE ELECTRICAL CYCLE

5.9.1 Reference

- a. NASA Specification 10A00465, paragraph 4.3.11.

5.9.2 Units To Be Tested

Twelve (12) each - see Table I.

5.9.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Accuracy</u>	<u>Calib. Interval</u>
Temperature Chamber	Messimers	FT-4	N/A	N/A
Temperature Recorder	Honeywell	31F1	$\pm 2^{\circ}\text{F}$	3 Months
D.C. Power Supply	Perkins	TVCR-040-5	N/A	N/A
Function Monitor	Douglas	SA 1077-1	$\pm 1\%$	3 Months
Oscillograph	Honeywell	906	N/A	N/A
Cable	Douglas	SA 1077-3	N/A	N/A

5.9.4 Test Requirement

Cycle the unit from SAFE to ARMED to SAFE four (4) times each at voltage inputs of 24 vdc, 28 vdc, and 32 vdc. The current required to actuate the solenoid or motor shall be monitored and recorded with each application of power. Elapsed time for 90° rotation shall not exceed 250 milliseconds. The above test shall be conducted as specified while the unit is stabilized at +165°F and then repeated again while the unit is stabilized at +20°F. NOTE: Sequence is optional. The +20°F cycling may be performed before the +165°F cycling.

5.9.5 Test Procedure

NOTE: Install an MS 3181-14 protective cap on all units before exposing to -65°F.

5.9.5 Test Procedure (Continued)STEP:

1. Place units into temperature conditioning chamber and stabilize at $+20 \pm 5^{\circ}\text{F}$ or $+165 \pm 5^{\circ}\text{F}$.
2. When units have stabilized at the test temperature make connections as shown on Figure 2. Connecting cable SA 1077-3 is to be inserted through chamber wall. The units are to remain in the chamber during the test.
3. Perform 90° rotation test using procedure of 5.8.5.1 with input voltages of 24 vdc, 28 vdc and 32 vdc.

NOTE: Once the units have stabilized at the test temperature and connecting cable 1077-3 has been attached the testing may proceed. It is not necessary to restabilize the temperature.

5.10 FUNCTION TESTS

QTP 816780

5.10.1 Reference

- a. NASA Specification 10A00465, paragraphs 4.3.12/4.3.15.

5.10.2 Units to be Tested (See Table I)

Units 1-3 and 13-14 function ARMED at plus $20 \pm 5^{\circ}\text{F}$.
 Units 4-5 function SAFE at plus $20 \pm 5^{\circ}\text{F}$.
 Units 6-8 and 11-12 function ARMED at plus $165 \pm 5^{\circ}\text{F}$.
 Units 9-10 function SAFE at plus $165 \pm 5^{\circ}\text{F}$.

5.10.3 Test Equipment

<u>Name</u>	<u>Manufacturer</u>	<u>Model</u>	
NSI Detonator	----	ME453-0021-007 or -009	Supplied by NASA
CDF Line	----	10A00455 or or equiv.	Supplied by NASA
Al. Tubing	N/A	6061-0	.125 OD x .020 wall
Firing Unit	----	C72-0833	Supplied by NASA
Debris Shield	----	10A00487	

5.10.4 Test Requirements

Units 1-3, 6-8 and 11-14 shall be in the ARMED position and functioned at plus 20°F or plus 165°F . Units 4-5 and 9-10 shall be in the SAFE position and functioned at plus 20°F or plus 165°F . The test set-up shall be per Figure 4.

5.10.5 Test Procedure (See Figure 4 and 4a)

- a. Torque the NSI detonators into each S&A device at 115-120 inch-pounds.
- b. Assemble the S&A device with the 10A00485 bracket to the mounting plate per Figure 4a. Install the 10A00487 debris shield for the "SAFE" tests only.

5.10.5 Test Procedure (Continued)

- c. Torque the CDF test lead assemblies into each S&A device at 60-90 inch-pounds.
- d. Remove the protective wrap from each CDF assembly to expose at least 1.62 inches of MDF.
- e. Install the 6061-0 aluminum tube over each section of MDF as shown in Figure 4.
- f. Place the unit into the temperature conditioning chamber and expose the unit to the specified temperature (see "Unit to be Tested" paragraph) for a minimum duration of one (1) hour.
- g. Remove the unit from the chamber, and initiate each detonator by the NASA firing unit within five (5) minutes after removal from the chamber.

5.10.6 Evaluation

- a. "ARMED" Function Test: The aluminum sleeve on each CDF test lead assembly shall be completely ruptured to indicate satisfactory operation of the test specimen.
- b. "SAFE" Function Test: There shall be no fragmentation of the S&A body or rotor. Satisfactory operation shall be indicated by no chemical decomposition of the test lead explosive.

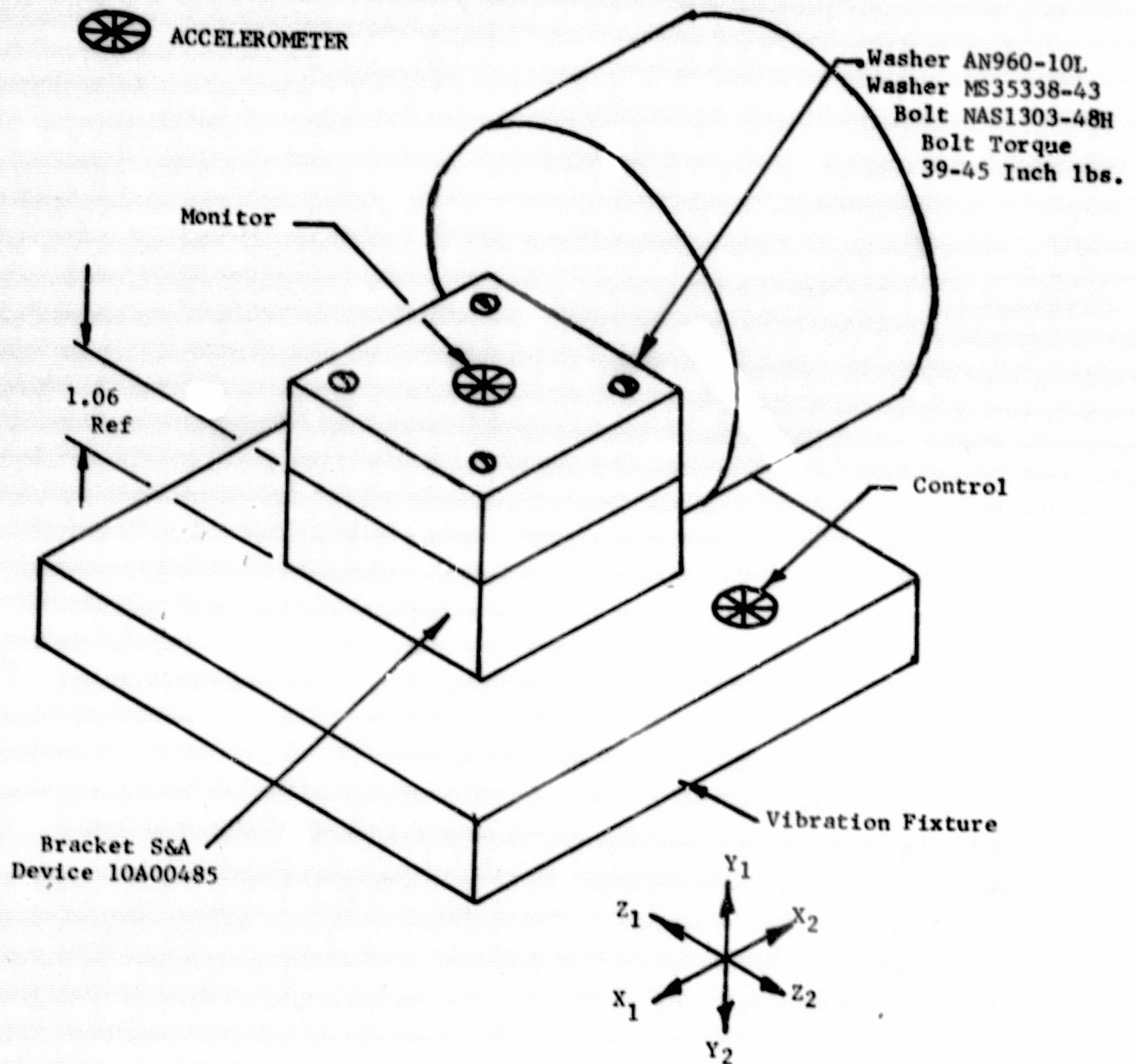
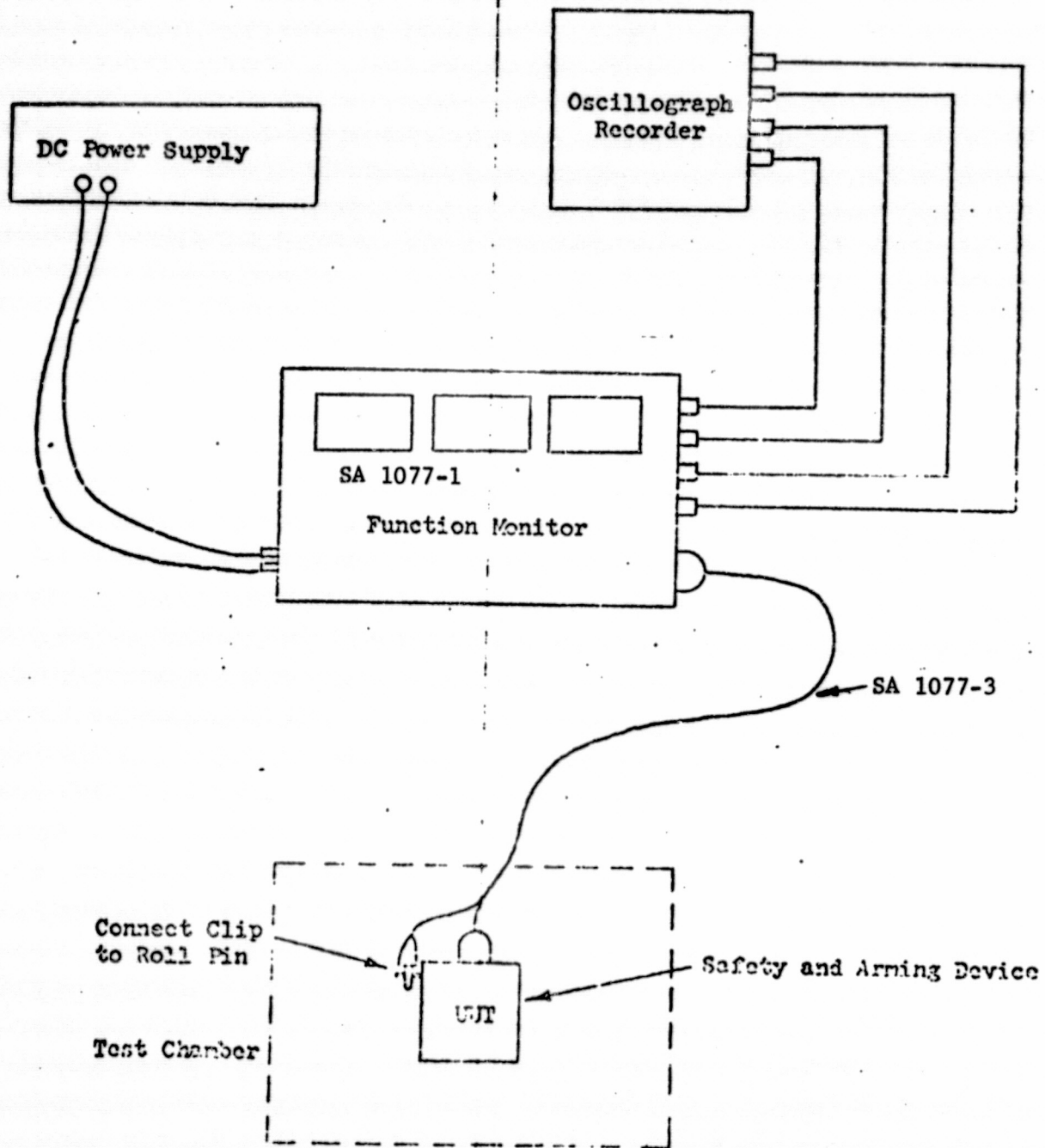


FIGURE 1
VIBRATION AND SHOCK TEST SETUP

OPERATIONAL AND ELECTRICAL TEST SET-UP

FIGURE 2



Timing Lines - at 100 pulses (lines) per second the time between lines is 10 milliseconds.

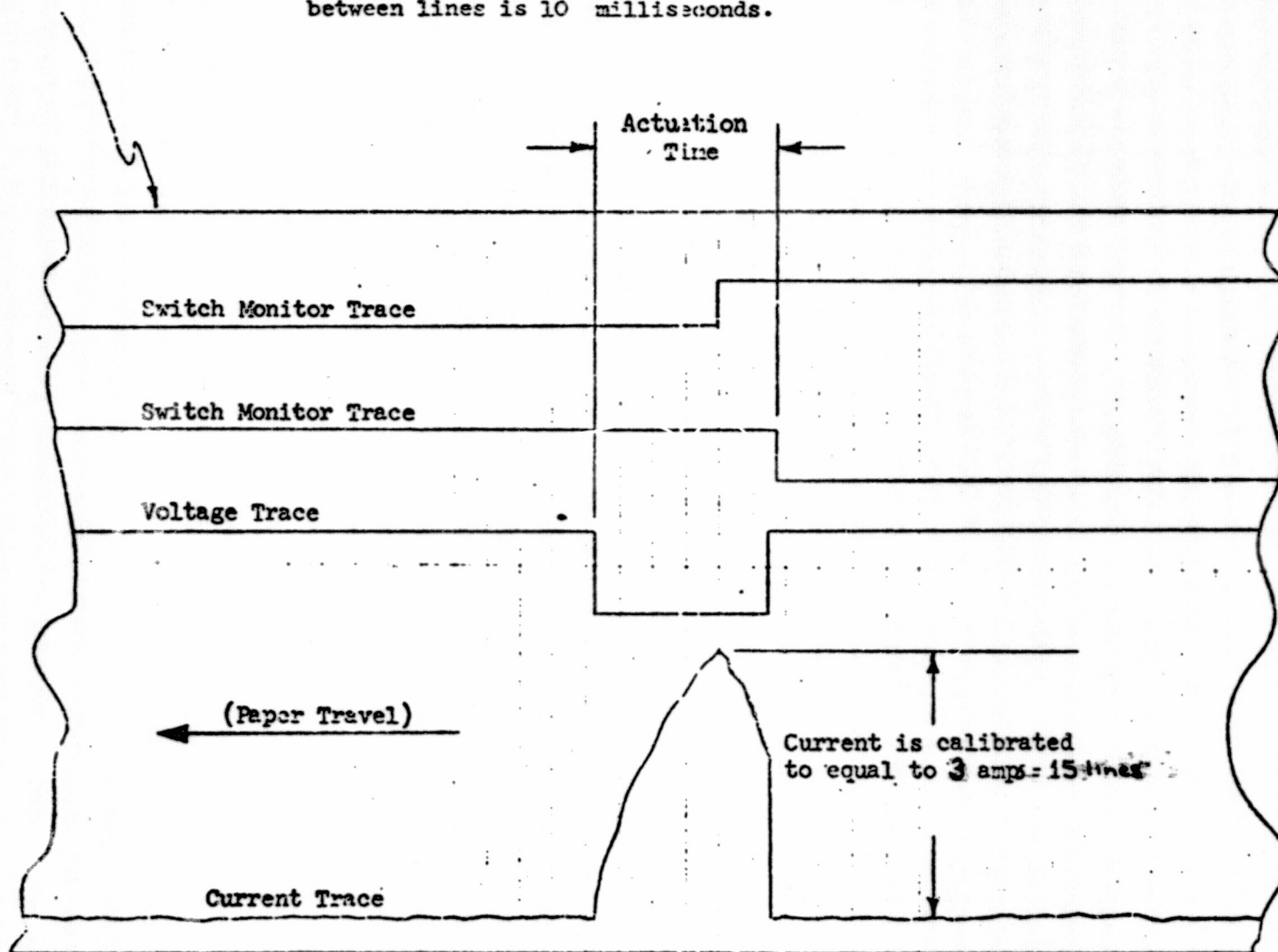


FIGURE 3
TYPICAL OSCILLOGRAPH TRACES

ORIGINAL PAGE IS
OF POOR QUALITY

- NOTES: 1) Actuation time is measured between the start of voltage application and the last switch monitor activation.
- 2) Polarity of the traces is not important.

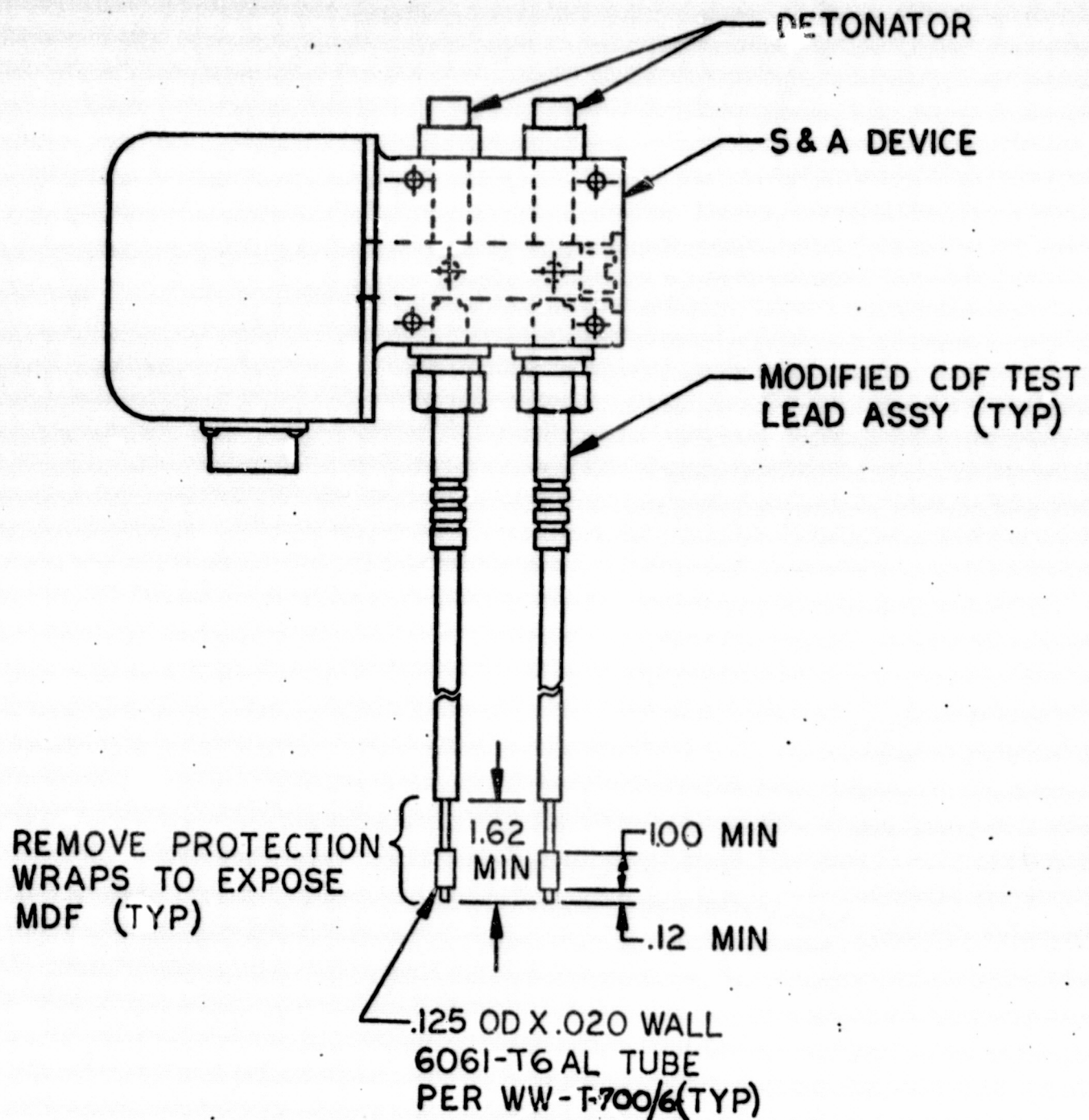
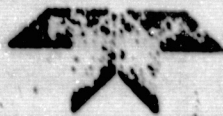


FIGURE 4
FUNCTION TEST SETUP



TELEDYNE McCORMICK SELPH
HOLLISTER, CALIFORNIA 95023

QTP 816780

TEST DATA SHEET
FOR
CIRCUITRY CHECKS

REPORT NUMBER _____

DATE _____

JOB NUMBER _____

W.O. NUMBER _____

TMc/S PART NAME SAFETY & ARMING DEVICE

TMc/S DWG. NUMBER 816780 REV. _____

CUSTOMER SPECIFICATION NASA 10A00465

TMc/S PROCEDURE ATP 816780 REV. _____

REQUIREMENTS: SAFE POSITION

ARMED POSITION

A) G-H, K-N, P-R & S-T PIN TO PIN VOLTAGE
SHALL BE LESS THAN 750 MILLIVOLTS @
2.5 AMPERES

A) J-H, K-L, R-N, & T-U PIN TO PIN VOLTAGE
SHALL BE LESS THAN 750 MILLIVOLTS @ 2.5
AMPERES.

B) J-H, K-L, R-N & T-U PIN TO PIN SHOULD
INDICATE AN OPEN CIRCUIT.

B) G-H, K-N, P-R & S-T PIN TO PIN SHOULD
INDICATE AN OPEN CIRCUIT.

C) SOLENOID RESISTANCE SHALL BE 10.52-
11.72 ohms

UNIT S/N	①	RECORD VOLTAGE READING OR WRITE OPEN IN EACH COLUMN BELOW										OHMS
		G-H	K-N	P-R	S-T	J-H	K-L	R-N	T-U	F-M	V-CASE	
	S											
	A											
	S											
	A											
	S											
	A											
	S											
	A											
	S											
	A											
	S											
	A											
	S											
	A											

① UNIT POSITION S = SAFE A = ARM

TECHNICIAN _____

WITNESS _____

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☐ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S _____

TEST DATA SHEET
FOR
CONTINUITY TEST

REPORT NUMBER _____ DATE _____
JOB NUMBER _____ W.O. NUMBER _____
TMC/S PART NAME _____ TMC/S DWG. NUMBER _____
CUSTOMER SPECIFICATION _____ TMC/S PROCEDURE _____
TEST EQUIPMENT ITEM NUMBERS _____
REQUIREMENTS _____

CUSTOMER PART NUMBER _____

[illegible]

TECHNICIAN

WITNESS

EVALUATION OF TEST RESULTS (CHECK ONE)

- ☐ ABOVE TESTS CONDUCTED WITHOUT ADVERSE EFFECTS
☐ DISCREPANCY/S NOTED OF UNIT/S _____

FIGURE 4A

